JUL 24 1947

ENGINEERING NEWS-RECORD

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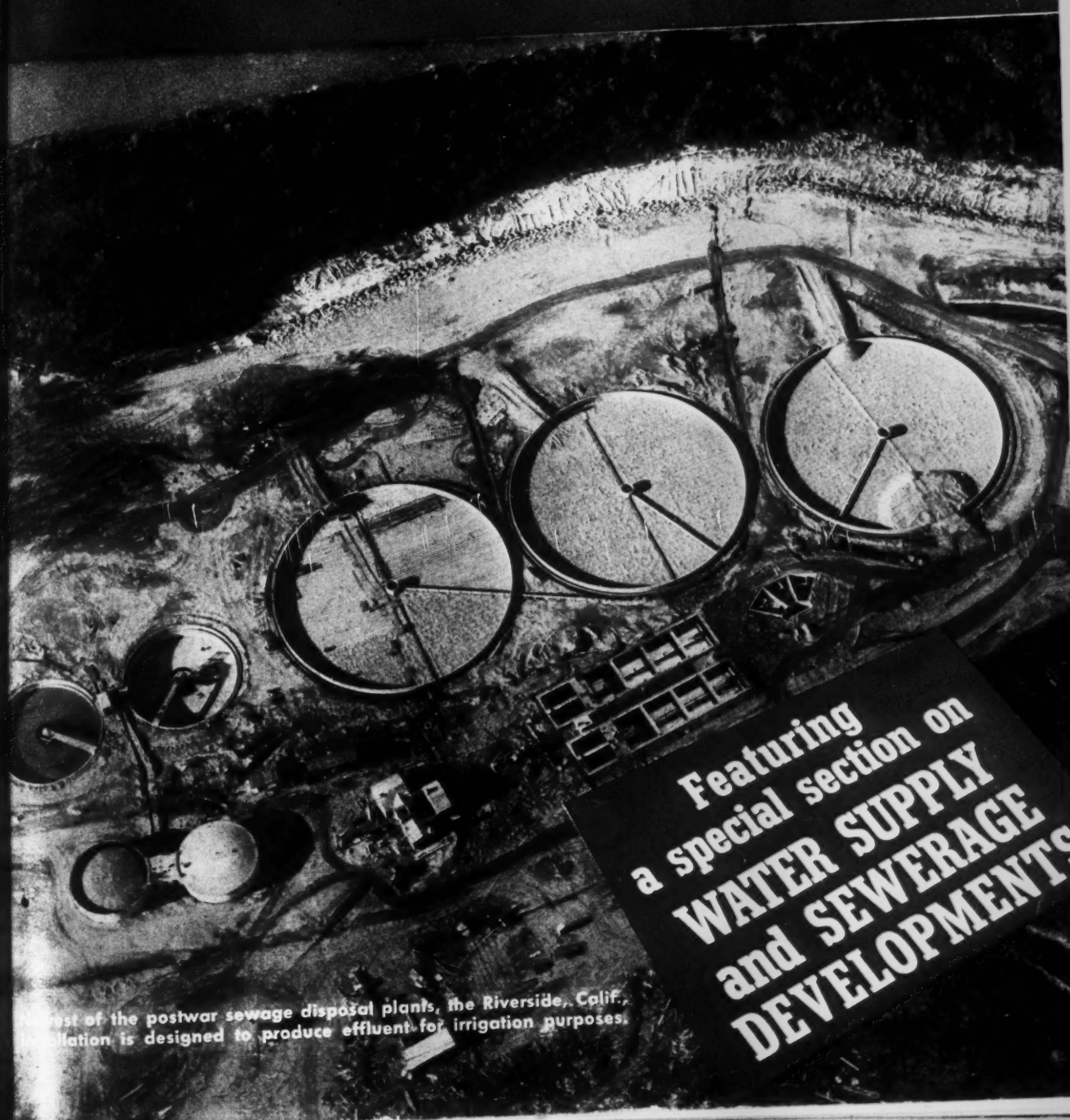
JULY 10, 1947



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...st of the postwar sewage disposal plants, the Riverside, Calif., ...allation is designed to produce effluent for irrigation purposes.

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The illustration shows the 12-inch, 1200-foot wrought iron line during installation. Sections are welded, and each joint is enclosed in a split sleeve, fabricated of 14-inch OD wrought iron pipe with ½-inch wall. As sections are added, the line is moved out to sea by tackle attached to loops welded to the pipe wall. The free end of the line is carried by the two vessels visible in the distance. Work was handled by Thomas Proctor Company, which has made a number of outfall installations along the Atlantic coast.

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Volume 139 • Number 2 JULY 10, 1947

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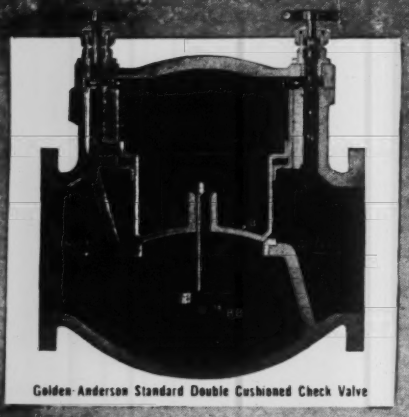
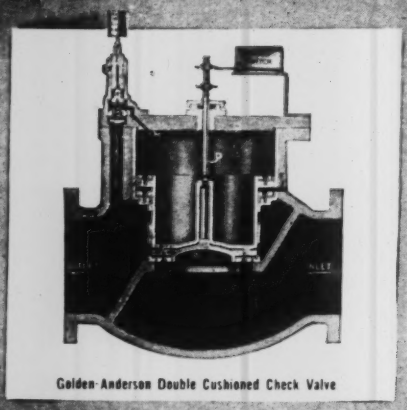


Golden-Anderson Standard Double Cushioned Check Valve



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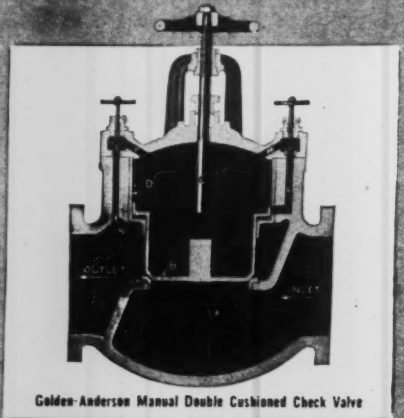

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Construction Trends

Construction Prices Show Promise of Stabilizing Close to Current Rates

Structural steel and cement prices have held firm in July at May levels, while lumber prices have declined 7.9 percent from the April peak, as reported by *Engineering News-Record's* 20-cities averages. Skilled and common hourly wage rates in July, however, continued the rate of rise evident in June and reached an average of $2.073 and $1.217 per hour, as compared with the June average of $2.013 and $1.189, respectively.

Cement prices during the last six months ending June, 1947 rose approximately 6.5 percent. This gain was practically equal to the gain of 5.1 percent made during the entire year of 1946. Thus prices in the past year and a half have shown a rise of only 12 percent, or the smallest rise for any of the basic cost factors. Cement prices averaged $2.15 per bbl., not including the cost of bags or bagging, in January, 1946, $2.21 in June, 1946, $2.26 in December, 1946 and $2.41 in June, 1947.

The over-all peak for the present upward price trend in cement was reached in May 1947. About half of the individual cities reporting, however, reached their peak from March to May while the remaining cities were unchanged at the prices reached early in 1947.

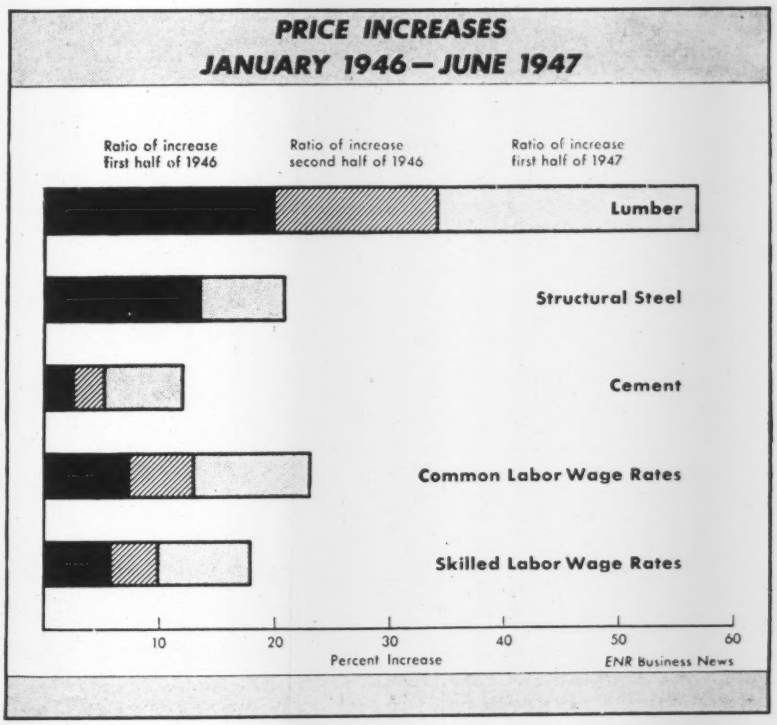
The structural steel base price rose to $2.50 per cwt. in February of this year and has remained unchanged through July. This was a rise of 6.4 percent over the previous price of $2.35 and 20.9 percent over the January, 1946 price of $2.0675.

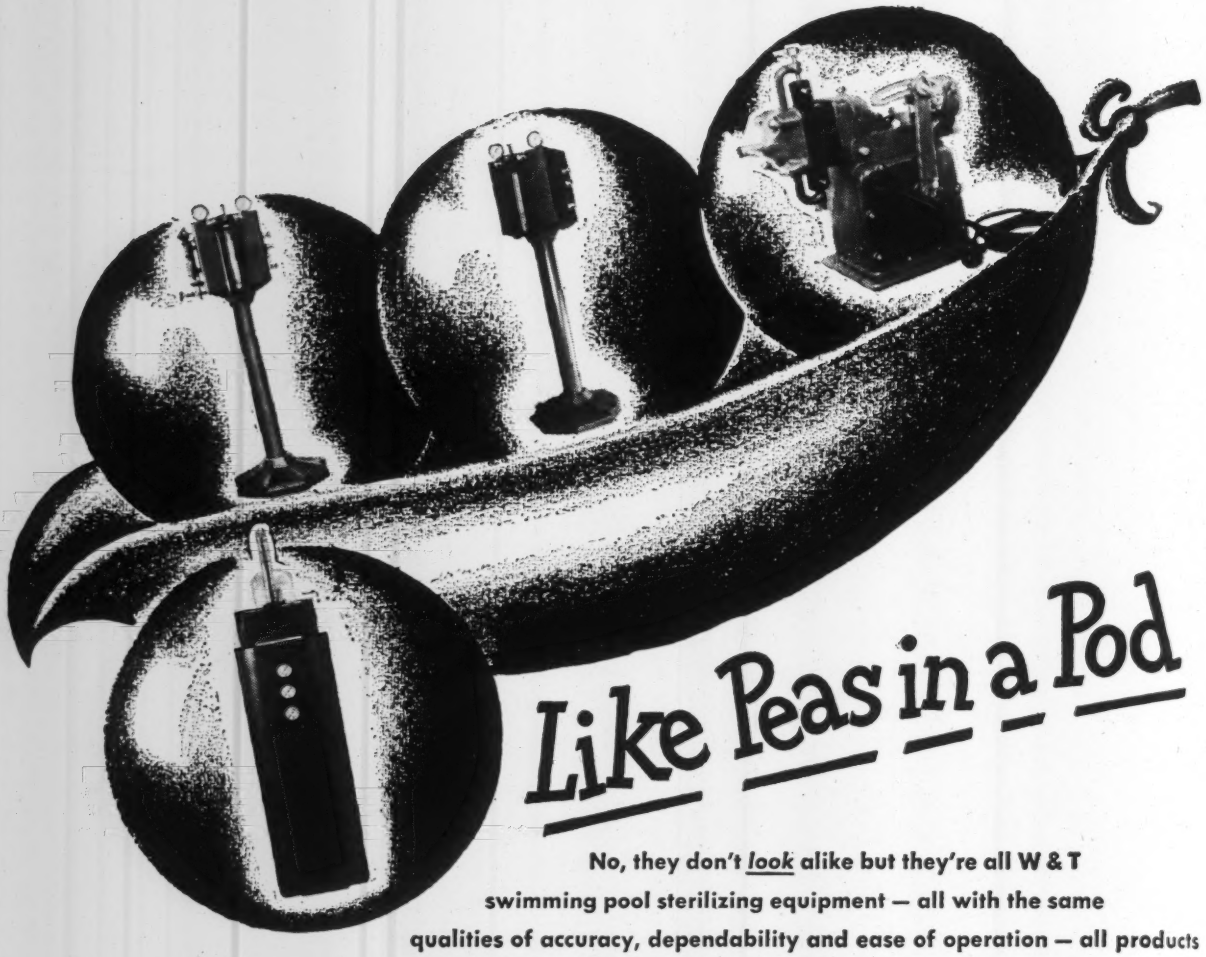
Since *Engineering News-Record's* lumber price average reached a peak of $88.97 per M ft. bm. in April 1947, prices have been declining in several cities each month. The price average in July has dropped to $81.91, or $7.06 per M ft. bm. below the peak as the result of a slackening of the demand.

The July lumber price average, however, is still 51.9 percent above the prices at the beginning of 1946, as compared with an increase of 57.1 percent in June, 1947 over January, 1946. The high level of prices reflects the shortage of supplies in the face of a strong potential demand evident during 1946 and the early part of 1947.

The greatest portion of the increase in the past year and a half, beginning with January, 1946 was evident in the last six-month period ending June, 1947, which accounted for approximately 40 percent of the total increase. Lumber prices rose from $53.92 per M ft. bm. for 2x4 fir and pine in January, 1946 to $64.61 in June, to $72.42 in December, 1946 and to $84.69 in June, 1947.

Wage rates paid to construction workers from January, 1946 through June, 1947 rose 18 percent for skilled labor and 23.2 percent for common labor. About 45 percent of this wage increase was made in the last six-month period. Skilled labor wages rose to $2.013 per hour in June, 1947 from $1.875 in December, 1946. Common labor wages rose to $1.189 in June from the December, 1946 average of $1.091. Fourteen of the twenty reporting cities showed gains in the past three months.





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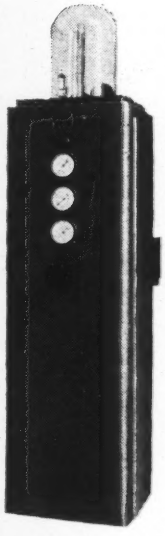

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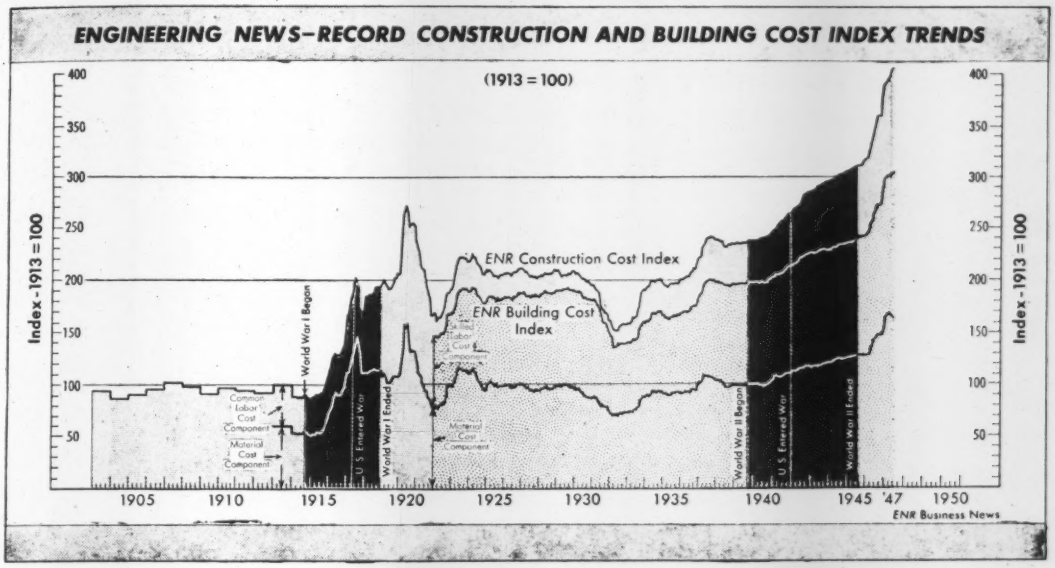
JULY CONSTRUCTION BUSINESS REPORT

ENGINEERING NEWS-RECORD CONSTRUCTION AND BUILDING COST INDEX TRENDS



ENR CONSTRUCTON VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	June 1946 (4 wk.)	June 1947 (4 wk.)	% Change	Six Months 1946 (26 wk.)	Six Months 1947 (26 wk.)	% Change
Total U. S. Construction	$555,469	$517,175	−7	$2,632,186	$2,673,865	+2
Private Construction	349,189	251,909	−3	1,678,739	1,542,435	−8
Public Construction	206,280	265,266	+29	953,447	1,131,430	+19
Federal	64,932	105,821	+63	313,702	331,938	+6
E N R Construction Volume Index, 1913 = 100	343	276	−20	264	227	−14
Total New Productive Capital	72,919	197,677	+171	667,398	889,245	+33
Private Investment	72,919	197,677	+171	509,078	889,245	+75
Federal (non-federal work)	.....	.....	.....	.....	.....	.....
Federal (federal work)	.....	.....	.....	158,320	.....	.....

CONSTRUCTION COST . . . . WAGE RATES . . . . MATERIAL PRICES

1913 = 100	July 1946	July 1947	% Change	Change June to July 1946 June	1946 July	%	Change June to July 1947 June	1947 July	%
E N R Constr. Cost Index†	354.70	406.52	+14.61	348.72	354.70	+1.71	403.29	406.52	+0.80
E N R Building Cost Index†	267.25	304.87	+14.08	265.28	267.25	+0.74	303.14	304.87	+0.57

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$1.058	$1.217	+15.03	$1.034	$1.058	+2.32	$1.189	$1.217	+2.35
Skilled Labor (Av. 3 Trades)	1.811	2.073	+14.47	1.798	1.811	+0.72	2.013	2.073	+2.98
Bricklayers	1.928	2.217	+14.99	1.918	1.928	+0.52	2.171	2.217	+2.12
Structural Ironworkers	1.825	2.091	+14.58	1.80	1.825	+1.39	2.007	2.091	+4.19
Carpenters	1.688	1.938	+14.81	1.677	1.688	+0.66	1.861	1.938	+4.14
Reinforcing Steel, cwt.	3.314	3.886	+17.3	3.240	3.314	+2.3	3.861	3.886	+0.6
Structural Steel, base	2.35	2.50	+6.38	2.35	2.35	0.0	2.50	2.50	0.0
Sand, per ton	1.405	1.787	+27.19	1.395	1.405	+0.72	1.790	1.787	−0.17
Lumber, 2x4 Fir, per M ft.	67.847	86.38	+27.32	66.515	67.847	+2.00	88.19	86.38	−2.05
Lumber, 2x4 Pine, per M ft.	60.90	77.51	+27.27	60.412	60.90	+0.81	80.87	77.51	−4.15
Common brick, per M	21.125	22.925	+8.52	21.125	21.125	0.0	22.95	22.925	−0.11
Ready-mixed concrete, c.y.	8.071	8.934	+10.69	7.973	8.071	+1.23	8.934	8.934	0.0
Struct. clay tile, 3x12x12	94.628	114.62	+21.13	92.316	94.628	+2.50	112.69	114.62	+1.71

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	June 1946	June 1947	% Change	May 1947	% Change May to June		
Steel (% operating Capacity) A.I.S.I.	75.7	96.3	+27	94.1	+2		
	April			**Four Months**			
	1946	1947	% Change	1946	1947	% Change	
Cement, thous. bbl. U.S.B. of Mines	15,369	15,414	+0.3	43,331	44,376	+2.4	
	May			**Five Months**			
	1946	1947	% Change	1946	1947	% Change	
Fabricated Structural Steel, tons, A.I.S.C.	111,686	136,443	+22	498,348	691,814	+39	
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$224,206	$215,496	−4	$1,292,730	$1,002,363	−22	

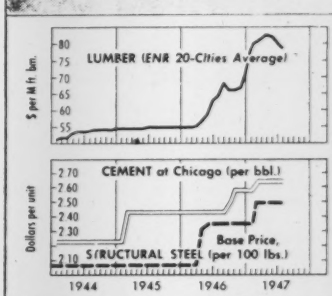
COST OF LIVING INDEX . . . . EMPLOYMENT

	May 1946	May 1947	% Change	April 1947	% Change Apr. to May
Consumers' Price Index, B L S	131.7	155.8	+18.3	156.1	−0.2
Rent (Housing) Index, B L S	108.4	109.2	+0.7	109.0	+0.2
	June				
	1946	1947	% Change	May 1947	% Change May to June
Const. Employment (est.), thous., B L S	2,072	2,026	−1.7	1,848	+9.6
Private Const. Employ. (est.), thous., B L S	1,939	1,576	−18.7	1,442	+9.3

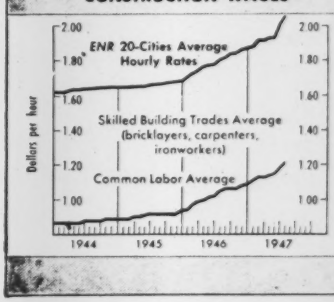
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
July, 1947	406.52	195.41	304.87	164.80	...	...
June, 1947	403.29	193.86	303.14	163.87	276	121
May, 1947	396.49	190.59	299.61	161.96	224	98
Apr., 1947	396.09	190.40	300.81	162.61	247	108
Mar., 1947	391.93	188.40	298.82	161.53	220	96
Feb., 1947	390.76	187.84	297.38	160.75	197	86
Jan., 1947	381.68	183.47	288.78	156.11	195	86
Dec., 1946	368.10	176.95	278.49	150.54	207	91
Nov., 1946	362.47	174.24	273.71	147.96	164	72
Oct., 1946	360.94	173.50	272.74	147.43	233	102
Sept., 1946	360.19	173.14	272.04	147.06	233	98
Aug., 1946	361.37	173.71	271.98	147.02	258	113
July, 1946	353.89	170.11	266.13	143.86	327	144
June, 1946	347.91	167.24	264.16	142.80	344	151
1946 (Av.)	345.74	166.19	261.87	141.55	250	110
1945 (Av.)	307.74	147.93	239.14	129.27	123	54
1944 (Av.)	298.63	143.39	234.73	126.89	95	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77

MATERIAL COST PRICES



CONSTRUCTION WAGES



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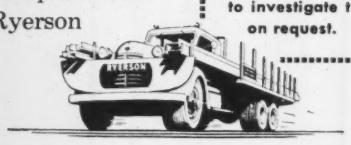


RYERSON STEEL

New Construction Volume in June

Civil engineering construction volume in continental United States totals $517,175,000 for June, an average of $129,294,000 for each of the four weeks of the month. This average is 26 percent above the average for May, but 7 percent below the average for June, 1946, according to *Engineering News-Record*.

Private construction for June on a weekly average basis is 12 percent above last month but 28 percent less than June, 1946. Public construction is 43 percent above last month and 29 percent above last June. State and municipal construction is 25 percent above last month, and 13 percent above the average for June, 1946. Federal construction, up 82 percent from last month, is 63 percent above June, 1946.

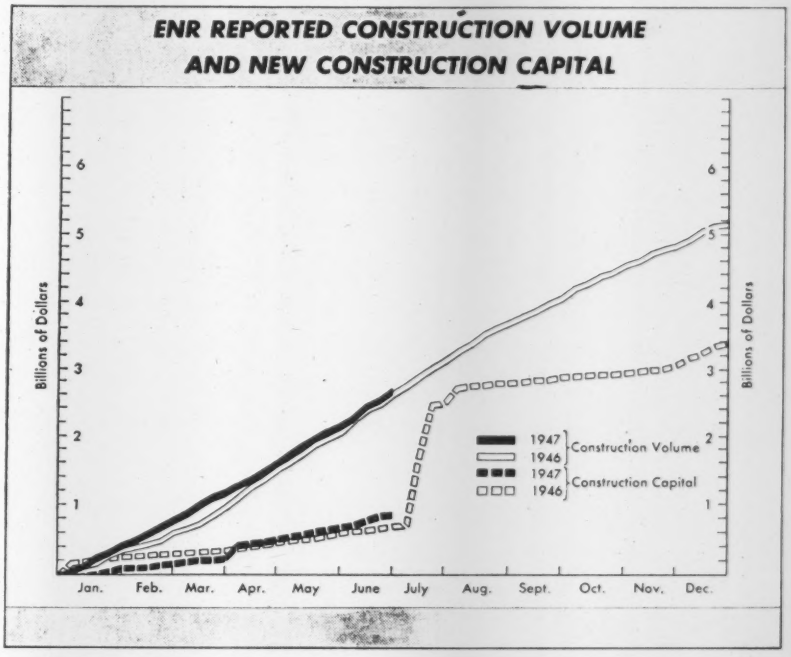
Weekly averages in the various classes of construction for June, 1947 compared with May, 1947 show gains in earthwork and drainage of 204 percent; public bridges, 68 percent; sewerage, 67 percent; public unclassified, 54 percent; commercial buildings, 33 percent; highways, 18 percent; public buildings, 4 percent; and waterworks, 2 percent; losses in industrial buildings 16 percent; and private unclassified, 5 percent.

Geographically stated, five sections showed gains in June, 1947 over May —Middle Atlantic, 72 percent; South, 66 percent; Far West, 16 percent; Middle West, 5 percent; and West of the Mississippi, 4 percent. New England dropped 48 percent below May.

Three sections showed gains in June over June, 1946—South, 49 percent; Middle West, 11 percent; and West of the Mississippi, 11 percent. Losses were recorded by New England, 54 percent; Far West, 34 percent; and Middle Atlantic, 23 percent.

New capital for construction purposes for the four weeks of June, 1947 totals $197,677,000, or a weekly average of $49,419,000.

The June, 1947 average is thus 43 percent above the May, 1947 average, and 171 percent above the average registered for June, 1946.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD — JUNE, 1947

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation*, $22,500; *other public works*, $40,000; *industrial buildings*, $55,000; *other buildings*, $205,000

Four Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States — June 1947	United States — Six Months 1947	United States — Six Months 1946	Canada
Public Works										
Waterworks	380	821	1,540	885	684	1,145	5,455	55,627	46,249	622
Sewerage	106	8,218	2,868	4,171	2,340	2,097	19,800	64,171	45,880	188
Bridges, public	817	5,853	4,128	1,197	1,794	3,627	17,416	81,102	62,466	308
Earthwork and waterways	424	1,243	1,160	20,720	27,147	1,426	52,120	156,940	194,714	358
Streets and roads	2,108	12,659	25,982	13,469	18,095	13,041	85,354	378,185	358,836	11,256
Buildings, public	2,790	10,240	5,194	3,193	9,887	10,911	42,215	252,419	162,959	10,805
Unclassified, public	1,378	1,577	20,098	3,585	9,896	6,372	42,906	142,986	82,343	2,212
Total public	**8,003**	**40,611**	**60,970**	**47,220**	**69,843**	**38,619**	**265,266**	**1,131,430**	**953,447**	**25,749**
Federal government (included in above classifications)	1,382	7,645	21,974	21,384	41,945	11,491	105,821	331,938	313,702	.....
Private										
Bridges, private	.....	93	.....	128	.....	.....	221	684	1,471	.....
Industrial buildings	825	13,854	4,478	10,354	15,268	5,172	49,951	388,629	526,915	11,722
Commercial buildings	3,340	71,823	18,815	3,672	29,189	27,264	154,103	912,168	1,042,741	6,665
Unclassified, private	40	6,545	22,232	396	15,723	2,698	47,634	240,954	107,612	1,210
Total private	**4,205**	**92,315**	**45,525**	**14,550**	**60,180**	**35,134**	**251,909**	**1,542,435**	**1,678,739**	**19,597**
Total Engineering Construction:										
June, 1947 — 4 weeks	**12,208**	**132,926**	**106,495**	**61,770**	**130,023**	**73,753**	**517,175**	.....	.....	**45,346**
May, 1947 — 5 weeks	29,227	96,409	80,277	73,224	155,871	79,335	514,343	.....	.....	33,992
June, 1946 — 4 weeks	26,749	172,141	71,725	55,601	117,545	111,708	555,469	.....	.....	23,701
Six months — 1947	**104,469**	**666,632**	**467,309**	**352,514**	**616,743**	**466,198**	.....	**2,673,865**	.....	**218,616**
Six months — 1946	160,048	600,448	340,431	309,340	534,752	687,167	.....	.....	2,632,186	165,539

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News of the Week

ENGINEERING NEWS-RECORD • JULY 10, 1947 • VOLUME 139 • NUMBER 2

Mississippi flood crests reach 103-year record high

St. Louis gages show water within one foot of all-time record—Major levees built by Corps of Engineers stand firm—River receding with better weather

Army engineers and thousands of volunteer workers took a watchful "breather" at the end of last week, as the rain-swollen Mississippi River pushed its flood crest south of St. Louis, Mo., and the river appeared to be slowly receding within its banks after one of the most disastrous series of floods in history.

Fed by abnormal rains in its tributary streams, the great river reached a 103-year high of 40.3 ft. at St. Louis July 2—within one foot of the all-time record established in 1844. Barring a sudden excessive precipitation, Army engineers believed the greatest flood danger had passed.

Significantly, according to *Engineering News-Record's* editor on the scene, all of the levees that failed along the river's flood path were privately owned and built. Not a single levee in the flooded area that was built by the Corps of Engineers to present authorized standards was seriously threatened.

Flood box-score

The *ENR* staff man at St. Louis added the flood results in this manner:

Credit side: No Army Engineer-built levees failed in the flooded area—all proved ample both as to section and freeboard for floods of this magnitude; rescue work and damage and repair control was quickly and effectively organized.

Debit side: Of a total of 470,000 acres of levee-protected land in the St. Louis district, 105,000 acres were flooded, and an additional 208,000 of usable farm land were flooded in unprotected areas; Total estimated flood damage in the area was $11,643,000 as of July 3. By comparison, the 1943 flood, which crested at 38.9 ft. at St. Louis, inundated some 200,000 acres of land, and the 1944 flood inundated some 150,000 acres in the area (*ENR* May 18, 1944, vol. p. 748).

Failures listed

A list of major levee failures caused either by breeching, crevassing, subsidence over-topping or a combination of these factors, serves to emphasize the seriousness of the flood. It should be noted, however, that all of these old levees are privately-owned of so-called "substandard" design, with inadequate cross-section and often insufficient maintenance. None were built by the federal government.

Some of the better-known levee failures, together with the areas inundated and the dates of failure are: The Riverland District, 5,900 acres, June 10; Elsberry Annex, 3,600 acres, June 27; Stringtown-Fort Chartres, 11,000 acres, June 27; Chouteau Island, 2,400 acres, June 30; and the Degognia-Fountain Bluff levee, which flooded 29,000 acres when it failed June 30 as the result of a general rain of cloudburst intensity which occurred when the river was beginning to crest at that point.

Contrary to some newspaper reports, no apparent damage to any levee was evidenced by a mild earthquake, reported centered near St. Louis, which occurred at 11:25 p.m. on June 29.

Organization praised

Observers credited the swift and well-coordinated action of the St. Louis District, Corps of Engineers, with holding down the potentially far greater damage of the flood.

Under the leadership of Cols. Clark Kittrell and R. E. Smyser Jr., division and district engineers; and L. B. Feagin and Donald S. Blair of the St. Louis District office, flood-fighting crews remained on 24-hour alert throughout the emergency period. In addition to some 500 regularly employed civilian personnel and about 900 troops from various Army detachments in the area, an estimated 10,000 volunteers engaged at one time or another in fighting the flood.

Midwest floods top all-time records

For the fifth consecutive week, heavy rains throughout the midwest drove tributaries of the Mississippi River to new flood stages last week, precipitating what the U. S. Weather Bureau said was

(*Continued on page* 87)

***River at Door**—Rising to a flood stage of more than 40 ft.—very close to the all-time high—swollen waters of the Mississippi River cover St. Louis' "front doorstep" as terminals and waterfront installations are covered. The famed MacArthur Bridge remains high and dry at the right of the photo.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Industrial Construction—The *Hartford, Conn.*, Electric Light Co. announced a $12,000,000, three-year construction program to raise its generating capacity and for additions to its power distribution system. . . . More than 25 miles of 1-in. steel pipe, in 481 individual coils serviced in a continuous enclosed system, is being installed in a three-acre heating system at a new warehouse being built by the National Tube Co. at *Lorain, Ohio.* . . . The George Innes Co., *Wichita, Kan.*, department store, announced it will start work soon on a $1,000,000, 7-story building. . . . . The Westinghouse Electric Corp. plans erection of an $850,000 addition to its *Buffalo, N. Y.* plant. . . . A 7-story, $2,000,000 hotel and apartment building is to be erected next fall in *La Jolla, Calif.*, by Del Thurber, local contractor and William H. McCreary. . . . A $1,000,000 warehouse building, one of the largest industrial construction jobs in the *Trenton, N. J.*, area is nearing completion for the Westinghouse Electric Co. . . . Construction will begin in August on a 7-story $1,000,000 home for the Merchants State Bank in the business district of *Dallas, Tex.*

Public Construction—The first unit in the University of Chicago's $2,000,000 faculty housing project will be started immediately, University officials said. The project will cover a city block with five eight-story elevator buildings, ten three-story walk-ups, and a public garage. . . . Actual construction work is expected to start next year on a $16,000,000 Southwestern Medical Center in *Dallas, Tex.*, to be built around a $7,000,000 veterans hospital. . . .A $3,000,000 building program for St. Lawrence University has been proposed by the planning committee of the university's board of trustees. . . . Preliminary plans have been accepted and drawings are being prepared for start on construction of a new Hospital for Sick Children in *Toronto, Canada.* The 12-story structure will provide 545 beds at an estimated cost of $10,000,000. Govan, Ferguson and Lindsay are architects and Gordon L. Wallace is engineer; Stone & Webster Engineering Corp. of Boston, Mass., is project manager.

Highways—Construction work has started on a new bridge at *Monticello, Ind.*, crossing the Tippecanoe River as a link in U. S. Route 24. Completion is scheduled for 1948, under a $425,000 contract let to Smith & Johnson of Indianapolis, Ind. . . . A low-level bridge across the York River between *Yorktown* and *Gloucester Point, Va.*, has been approved by the Virginia State Highway Department. . . . *South Dakota* now has 18 highway repair projects underway.

Labor—All American Federation of Labor common laborer's unions in *North Dakota* have filed a joint strike notice with the National Labor Relations Board, for a strike against all highway and heavy construction contractors in the state. Union spokesmen said the notice was to force a conference with contractors to achieve new wage scales. . . . Bricklayers in *Canton, Ohio* ended a 19-day strike against contractors affiliated with the Construction Council of Stark County, after winning a 25-cent hourly increase.

Hydro-power—A new concrete dam, 830 ft. long and 70 ft. high will be built on the Racquette River at *Carry Falls, N. Y.* by the Northern Development Corp. of Syracuse, N. Y. . . . Final local assurance for construction of the proposed Baldhill dam on the Sheyenne River near *Valley City, N. D.*, has been received by the St. Paul district of the Corps of Engineers from the North Dakota State Water Conservation Commission.

FOUR PWA JOBS CONTINUE

Four projects that started under the old Public Works Administration, with a total overall cost of more than $160,000,000, are still in progress and will require at least two more years for completion, Maj. Gen. Philip B. Fleming, administrator of the Federal Works Agency, told surprised Congressmen last week.

When PWA was ended on June 30, 1943, a number of projects remained to be completed. Four of these are still in progress: The Chicago subway system, expected to cost $63,000,000; the $53,000,000 Santee-Cooper hydroelectric and navigation project in South Carolina; the $44,000,000 Central Nebraska hydroelectric project, and the $590,000 Middle Creek Dam in Montana. More than $17,000,000 of work on these four jobs has yet to be completed, General Fleming said. No money is being asked of Congress at this time, however, since sufficient carryover funds are available.

General Fleming's FWA has the task of completing the liquidation of PWA.

World soil-mechanics meeting date set

The Second International Conference on Soil Mechanics and Foundation Engineering will be held in Rotterdam, Holland, in June 1948, according to an announcement made last week.

Under the sponsorship of the Netherlands government, the meeting will be a resumption of a series initiated at Harvard University in 1936, and continued until interruption by the war. Karl Terzaghi, professor of engineering practice at Harvard, is president of the group. The 1948 meeting is being organized by J. P. Van Bruggen, director of public works of Rotterdam; T. K. Huizinga, director of the laboratory of soil mechanics in Delft, and other Dutch engineers.

In the United States, a National Committee on Soil Mechanics, under the chairmanship of Philip C. Rutledge, professor of civil engineering at Northwestern University, to include 35 outstanding foundation engineers and soil mechanics experts has been appointed.

Critical report made on Inter-American Highway

Every federal agency that had anything to do with the abortive effort to complete the Inter-American Highway as a war measure is sharply criticized in a report on that project made public by the Senate Special War Investigating Committee, on July 7. Included were the State Department, the Corps of Engineers, U. S. Army, the Public Roads Administration and the Office of Inter-American Affairs.

About 905 miles of the 3,261-mile Inter-American Highway remained to be built when, on Dec. 26, 1941, this country undertook to complete the road as a war measure to give land communication to the Panama Canal. The War Department then estimated the cost at $14,500,000. The committee found that when the work was stopped in 1943, only 347 miles had been built at a cost two and one half times the original estimate for the entire project.

The committee found no instances of corruption but concluded that there were excessive profits on the part of some contractors and that there were poor procurement policies and lack of coordination on the part of government agencies. It recommends that before more commitment for work on the highway are made, an Inter-American highway Commission or authority be set up by international agreement.

Fuller details of the committee's finding will be given in a subsequent issue.

$2 billion California road plan ready as Governor signs enabling legislation

More than half state's highways to be improved or rebuilt—Gasoline taxes raised to aid in financing

California is embarking on a two-billion-dollar, 10-year road and highway program under the Burns-Collier act passed in the closing days of the state legislative session and signed almost immediately by Gov. Earl Warren.

Substantially the same as the bill recommended by the Collier interim legislative committee on highways (*ENR* Nov. 7, 1946, vol. p. 609), the final bill was introduced and passed after the original bill—robbed of its tax-raising features by the Assembly—foundered in the compromise committee. (*ENR* May 29, vol. p. 869.)

Most controversial feature was a gasoline tax increase, pegged a 2c. by the Senate, removed entirely by the Assembly and finally set at 1½c. in the compromise bill.

The act calls for improvement or reconstruction of more than half of the state's highways. In addition, it adds 67.4 miles of heavily traveled routes to the state's system.

New taxes are levied that in their first full year will raise $64,000,000 in new money for use by the State Division of Highways and by cities and counties. Money available for state-highway construction is virtually tripled by the act.

Counting the $27,000,000 the Division of Highways has each year in present income, $91,000,000 will be available for state highways and major city and county routes.

Over a 10-year period, it is estimated that $757,000,000 in new and old money will be raised for state highways and $204,000,000 for county roads and city streets.

The latter amount is entirely new money, and is added to a one-cent-a-gallon share of the state gasoline tax the counties now receive and a quarter-cent share the cities receive under the present law.

Engineering study made

The Collier report followed an engineering study supervised by G. Donald Kennedy of the Automotive Safety Foundation. The Kennedy report said that the state, cities and counties should spend about $2,800,000,000 by 1959 on all highways, roads and streets. The Burns-Collier Act, which called for a start two years earlier than the Kennedy report will provide just about enough revenue, with federal matching funds and locally-raised money, to meet that amount.

The program is tied to a $1,674,000,000 "critical deficiency" report of the state Division of Highways. In the first five years, 50 percent of the money available for state work in each county must be spent on these "critically deficient" highways. In the second five years, 55 percent and in the third, 65 percent of the money must be spent on the deficiencies.

The "critical deficiency" program calls for improvement or reconstruction of 7,897 miles of the 13,886 miles in the state system.

The bill adds 67.4 miles of new city routes to the state highway system—all in Los Angeles, San Francisco and Alameda counties. These heavily traveled routes are estimated by the Division of Highways to cost $214,000,000, included in the critical deficiency total.

The city routes get a lower priority than other state highway construction. They must share in the 50-55-65 percent formula for work on critcal deficiencies and the "free money" above the percentages cannot be used on them, although it can be used on other state highways.

Under the bill the state takes over maintenance of state highways within cities. The cities have done the maintenance work under a quarter-cent share of the gas tax which is now returned to the state. The cities, however, retain another quarter-cent share, previously allocated to them for work on major city streets, and get a new three-eighths' share, as do the counties.

The new taxes the bill levies include:

A 1½c. increase per gallon in the gasoline tax, making it 4½c. a gallon.

A practical doubling of the weight fees on trucks.

A doubling of the $3 plate fee for passenger cars.

A 1½c. increase in the diesel fuel tax.

A new $2 fee for drivers licenses, good for four years.

All of drivers license revenue will go for increased services by the drivers license division.

W. A. Hardenbergh heads military service groups

William A. Hardenbergh, who was formerly chief sanitary engineer for the U. S. Army, and now president and editor of *Public Works Magazine*, has been appointed by both the American Society of Civil Engineers and the National Society of Professional Engineers as chairman of their committees on military services.

These committees are to study ways to utilize engineering personnel within the armed forces and work out a program whereby the engineering profession can contribute to national defense.

Midwest floods top all-time records

(Continued from page 85)

the midwest's "most disastrous flood on record."

Almost every midwestern tributary was in flood—many of the streams having reached crest heights greater than any previously recorded. Damage to farmlands, dwellings, manufacturing establishments, railroads, highways and public utilities was expected to run into millions of dollars.

A table of flood crests in the central Mississippi and lower Missouri valleys, prepared by the Weather Bureau, gave evidence of the severity of the floods.

The Raccoon River in Iowa, which had reached previous high crests of 16.2 and 18.8 at Jefferson and Van Meter, respectively, reach stages of 22.5 and 21.2 at the two towns during June. The Des Moines River crested at 26.5 at Des Moines, Iowa—less than one foot below the all-time high established in 1903, and the same stream topped 27 ft. at Boone during the past month.

The Mississippi itself reached its highest stage at St. Louis on July 2, when a crest of 40.3 ft. was recorded—more than a foot above the high registered in 1944.

The Missouri River rose progressively, from an all-time high of 20.1 ft. at Nebraska City, Neb.; to 28.1 ft. at Lexington, Mo.; to 32 ft. at Booneville, Mo., on June 27.

The Grand River reached its highest stage on June 24—33.2 ft. at Chillicothe, Mo. The Blue River went over its banks at Beatrice, Neb., as did the Platte River at Agency, Mo.

The 40.3-ft. crest of the Mississippi at St. Louis followed a torrential one-to-three-in. downpour of rain late on June 30, and was close to the all-time record stage of 41.4 ft., reached in 1844.

Congress speeds engineering bills

During the past week Congress has speeded up work on bills pertaining to the construction industry and important action was taken on a number of measures.

The House passed without amendment the War Department Civil Works Appropriation Bill (H. R. 4002) as it had been reported out a few days earlier by the appropriations committee, which favored $252,000,000 for flood control and rivers and harbors construction (*ENR* July 3, 1947, vol. p. 11) and the House as a whole approved this total without change. This action was taken despite attempts to eliminate funds for the Clark Hill Project on the Savannah River and a request for $5,000,000 to start Red Rock Dam on the Des Moines River in Iowa, where severe floods have occurred during recent weeks, plus other requests for increased appropriations.

Congress has given the U. S. Public Health Service contractural authority to the amount of $75,000,000 to start the $4 billion civilian hospital construction program to be carried out by that agency. No actual money was appropriated, but the service may enter into contracts obligating federal aid to the amount listed. This total, which is a compromise between $40,000,000 favored by the Senate and $150,000,000 by the House, will permit a start on a program that calls for $75,000,000 of federal aid yearly for five years.

Navy gets funds

A bill providing $127,000,000 for the construction of shore facilities by the Navy's Bureau of Yards and Docks was reported out by the House Armed Services Committee. This measure provides $34,000,000 for a guided missile test center at Point Mugu, Calif.; $39,000,000 for work on Guam Island, and $28,000,000 for an aeronautical turbine laboratory at Trenton, N. J. A total of $67,000,000 is supplied for work in the U. S. proper on 44 projects, while $60,000,000 is set aside for jobs outside the country.

Appropriation of $32,500,000 for construction of civilian airports was also agreed to before Congress sent to the President the appropriations bill for the Department of Commerce. The money will be spent under supervision of the Civil Aeronautics Administration, and the fund, along with a $45,000,000 appropriation last year, will permit a start on the $1 billion airport improvement program approved in the Federal-Aid Airport Act of 1946 (*ENR* May 16, 1946, vol. p. 763). Under this bill $500,000,000 of federal aid is authorized over a 7-year period with the assistance matched on a 50-50 basis by local groups.

A new stream pollution bill (H. R. 3990) incorporating the suggestion of the Federal Works Agency as outlined in *Engineering News-Record* May 22, 1947, vol. p. 847, has been introduced in the House by representative Mundt. Although the chances of completing congressional action this session on an abatement bill appears slim, in view of the big load Congress must move before it recesses late in July, the work now being done is expected to help in getting a bill passed next session.

To issue call for bids on Tacoma Narrows bridge

Bids will be asked in July for construction of a new bridge across Tacoma Narrows to replace the structure which collapsed during a wind storm in 1940, Clarance B. Shain, Washington state highway director, told the Tacoma Chamber of Commerce. The bid opening is scheduled for August.

Start on $100 million Texas medical center

With the start of foundation work last week for the $3,500,000 Hermann Hospital, more than $9,000,000 worth of construction is under way for the proposed $100,000,000 Texas Medical Center at Houston, Tex.

Hermann Hospital is the third building to be started on the 161-acre site, four miles from downtown Houston, donated by the M. D. Anderson Foundation. The first building started was the $3,500,000 reinforced-concrete Baylor University College of Medicine, which is expected to be ready for the fall semester, and the second was the 14-story, welded-steel frame Hermann Professional Building.

Provision of 395 beds in the new Hermann Hospital will bring to 695 the number of beds provided by this institution.

The fourth structure will be a $500,000 shrine Crippled Children's Hospital, for which the Arabia Temple Shrine now has funds available.

Architectural plans are being completed for a $3,000,000 St. Luke's Hospital, and the $3,500,000 Methodist Hospital, as well as for a 300-bed Tuberculosis Hospital to be built for the City of Houston.

Canada construction firm names new officers

The Foundation Company of Canada, Ltd., recently announced the appointment of two new vice-presidents and a secretary for the organization.

Chipman E. Grearson has been named vice-president and treasurer, and William U. Smick vice-president in charge of engineering construction.

Mr. Grearson has been with the firm

C. E. Grearson

W. U. Smick

throughout the past 33 years, while Mr. Smick worked with the company and its former American affiliates for over 39 years. The company carries on an extensive marine salvage business on the Atlantic seaboard in addition to its building and engineering construction activities.

Standard of California names pipeline engineer

H. H. Hall, chief engineer for the Standard Oil Co. of California since 1921, has been appointed vice president and chief engineer of the Trans-Arabian Pipeline Co., to supervise design and construction of a 1,050-mi. oil pipeline across Arabia to a shipping port on the Red Sea.

Mr. Hall is succeeded as chief engineer for Standard by J. Marshall Evans, who has been assistant chief engineer since 1944. Both men joined the company in 1910.

H. H. Hall

J. M. Evans

Mr. Hall is a civil engineering graduate of Stanford University, and is a past president of the San Francisco section, ASCE.

President signs new rent-control bill removing most curbs on construction

Truman scores Congress for weakness of measure—Housing expediter issues new rules under law

President Truman has added his signature to make law H.R. 3203, removing federal controls on all types of construction other than facilities for recreational and amusement purposes.

Although the President severly criticized removal of controls at this time, the new law met with the approval of the Associated General Contractors, the Producers' Council, and other strong groups in the construction industry.

Signing of the bill was followed by new regulations from the Office of the Housing Expediter, setting forth the procedure to be followed in enforcing the few remaining controls, since the new law eliminates most of the features of the Patman Emergency Housing Act (*ENR* June 26, vol. p. 987). It also wipes out the $50,000,000 ceiling on weekly approvals of non-housing construction, but extends the life of the OHE until Feb. 29, 1948.

President seeks housing aid

President Truman criticized Congress for failing to follow his request of Jan. 6, 1947, for comprehensive housing legislation, and the real estate groups for their work in blocking such legislative action. Declaring that the federal government must play a strong role to meet the housing shortage, he offered a six-point program to make this action possible:

(1) To provide public aid to localities for low rent housing for families in the lowest income group; (2) to encourage private investment in rental housing by federal insurance; (3) to extend aid to cities for the clearance of slums and blighted areas; (4) to perfect and supplement existing aids to home financing; (5) to provide a substantial program of housing research to assist industry in progressively reducing the cost of housing, and (6) to provide a more adequate program of farm housing.

AGC sees benefits from law

In contrast, the AGC expects major benefits to result from the new law. Views of this organization were expressed by H. E. Foreman, managing director, who said:

"The freeing of industrial and commercial construction from federal control will not interfere with necessary residential construction. Housing, which never could be considered independently from other types of needed construction, will go ahead with other work that is necessary for the development of the nation. Plant expansion programs and plans for new commercial construction that will provide additional employment opportunities can now be undertaken without regard to an arbitrary federal quota on the amount of new construction work that would be approved."

An equally bright view was taken by the Producers' Council, which saw a decline in the cost of building materials "as full and free competition comes into play."

New regulations Issued

Housing Expediter Frank R. Creedon, meanwhile, issued regulations for enforcing the new controls. His office has ruled that federal approval must be obtained for projects for amusement or recreational purposes if the cost of the job is over $2,500.

Applications for this type of work must be made by using application form OHE 14-171. These requests must be sent directly to the office of the housing expediter in Washington where they will be acted upon by the non-residential construction branch of that agency. The field offices of OHE are being discontinued, but the application blanks mentioned will be in these offices until July 31. They will also be available in the 600 OHE rent offices.

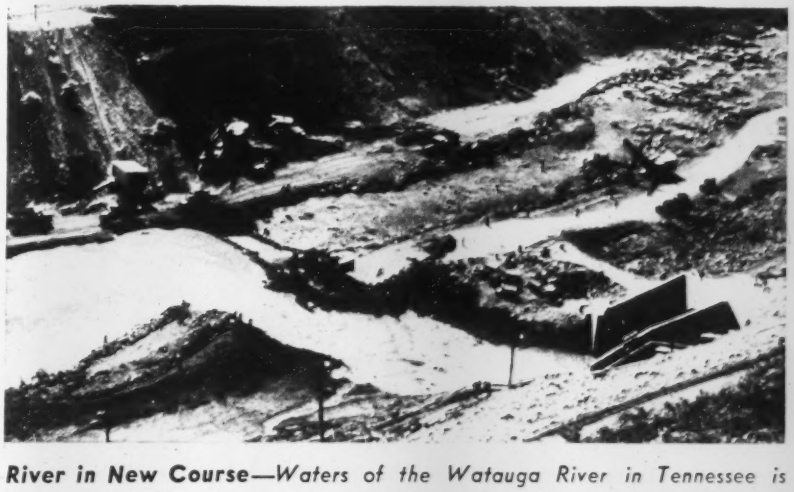
A long list of building types that still must be approved has been issued by OHE. This list includes: amphitheaters, amusement piers, amusement parks, arenas, assembly halls used primarily for amusement or recreational purposes, athletic field houses, bath houses, baseball parks, bleachers, boardwalks, boat clubs, bowling alleys, canteens, country clubs, community recreation buildings, dance halls, gymnasiums, night clubs, race tracks of all kinds, riding academies, rodeos, skating rinks, stadiums, swimming pools, taverns and theaters.

Start work on $18 million Concho Dam in Texas

Federal and Texas state officials last week attended ground breaking ceremonies marking the start of work on the $18,000,000 dam on the North Concho, about 3 miles from San Angelo, Tex.

The multiple-purpose dam, primarily for flood control and water conservation, will have an earth embankment with a maximum height of about 130 ft. above the stream bed, and will form a reservoir with a total storage capacity of 437,000 acre-ft. of water. The embankment will be about 7 mi. in length.

The dam is expected to end flood danger on the North Concho river, one of the principal tributaries of the Colorado river of Texas. The work is being done under supervision of the Corps of Engineers.



***River in New Course**—Waters of the Watauga River in Tennessee is flowing through a diversion tunnel, after TVA workmen had completed a small diversion dam preparatory to start of construction on the dam site. Earth and rock fill in the main dam will rise to a height of 319 ft., and have a total crest length of about 840 ft. A third stage will include construction of a powerhouse that will house two 25,000 kw. units.*

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Planning work, zoning, smoke control occupy city officials—Los Angeles freeway work under way—Other municipal activities

Planning activities looking toward orderly—and economical—development of cities—were occupying the attention of officials in many cities last week.

In Indianapolis, Ind., Mayor Vernon McMillan of Terre Haute, addressing a 23-county Central Conference on Community Planning, warned that community planning must be supported by the people of the community if it is to succeed.

He described the method through which his administration had brought national attention to Terre Haute in its efforts to revitalize government services. "Every item of expense in city operations for a 10-year period was carefully studied and evaluated," he said. "An industrial expert examined the entire business structure of the city. New law enforcement rules brought a record of 61 percent fewer major crimes than the national crime average. Fire losses are now less than $1 per capita for the last two years.

"We have found that annexations of heavily constructed outlaying areas provide more efficient management of public utilities and services."

As if echoing Mayor McMillan's words, the city council of Toledo, Ohio, authorized the annexation of portions of neighboring Washington and Adams townships, with an estimated tax value of $20,000,000, to rectify the city's borders and provide services to the areas. The action was taken to meet a deadline set by a new state law which forbids such annexation without a majority vote of the entire population of a township.

Meanwhile, following closely on similar action in California and in Salt Lake City, the mayor of Richmond, Va., appointed an 11-man committee of businessmen to administer the city's new farreaching smoke control ordinance in cooperation with a smoke control engineer yet to be appointed. The ordinance declares that faulty emission of smoke and gases in the city has become a detriment to public health and sanitation, and creates the office of smoke control engineer and the board to make appropriate rules for abatement of the nuisance.

In Salt Lake City, the Utah State Finance Commission approved a second contract for a smokeless fuel plant cosponsored by the state and the Coal Logs Co., Inc., advancing an additional $10,000 to complete construction of the plant. The state has advanced $47,000 for the experiment as a contribution to reducing the heavy smoke content of the city's air during the winter.

Other action on building codes included: The adoption of a revised building code, based on the 1946 uniform building code compiled by the Pacific Coast Building Officials Conference at Boise, Idaho; the naming of R. G. Patterson as engineer for the development of Santa Rosa island, near Pensacola, Fla.

Highway plans

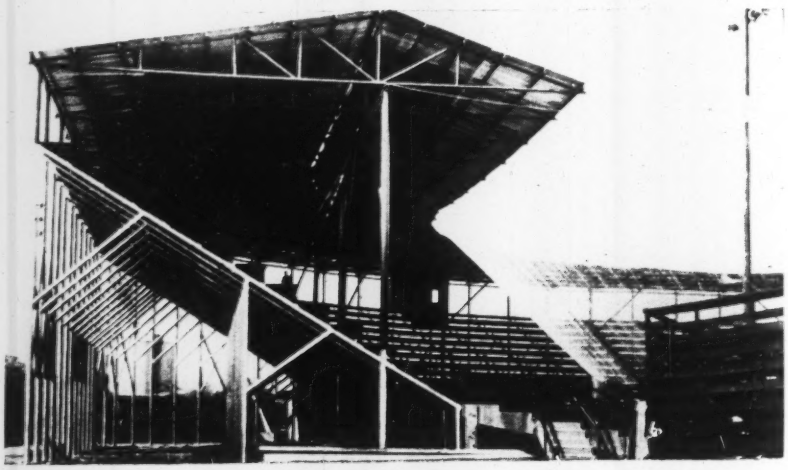
The three freeways under construction in Los Angeles—the Hollywood, Santa Ana and Harbor freeways—will displace a total of more than 17,000 persons, Los Angeles home builders officials said last week. The Hollywood freeway alone will require the moving or razing of 1,500 buildings and the transplanting of some 3,350 families. Initial construction on the three roads involves such heavy structures as bridges at certain major separation points, including a four level concrete and steel separation structure for the Hollywood freeway which has been awarded to the James I. Barnes Construction Co., of Santa Monica, Calif., for a low bid of $1,296,000. Designed by state highway engineers, the structure is expected to be completed in about 15 months after July 15.

While Los Angeles pushed work on its solution to its traffic problem, Kansas City, Mo., councilmen considered an ordinance that would call for an election on $35,500,000 in bonds to finance major street projects; W. C. Lefebvre, Arizona State Highway Engineer, urged formation of definite plans for a freeway through Phoenix; and Kentucky State Highway Commissioner J. Stephen Watkins said that a superhighway to connect the Kenton county airport, serving Cincinnati, with that city, would be included in a proposed superhighway for northern Kentucky.

Harbor projects

The Alabama State Docks Advisory Board last week authorized the advertising for bids for a $5,000,000 dock expansion project at Mobile. First step in the project will be to acquire about 10 square blocks along the city's waterfront and construction of three new docks.

At Gulfport, Miss., the city officials were advised that the Corps of Engineers have approved a city application for a deeper harbor and channel. Under the application the city would receive a channel 30 ft. deep at mean low tide, and 220 ft. wide. The project must await Congressional approval before any action can be taken.



***All-welded Grandstand**—Made almost entirely of pipe reclaimed from abandoned oil lines, this new all-welded grandstand now serves baseball fans at Wichita Falls, Texas. Framework of the stand is 4-in. and 5½-in. seamless pipe as uprights, with all bracing, roof supports and seat supports fabricated from 4-in. drill-pipe. The stand is 450 ft. long, has a maximum height of 28 ft., and will accommodate 8,000 persons. The entire structure was built in six weeks under supervision of the Wichita Welding and Manufacturing Co.*

EUROPEAN NOTEBOOK . . . .

Occupation Army Engineering

By WALDO G. BOWMAN

Frankfort-am-Main—The Army Engineers in Germany say they are doing housekeeping and not engineering, but a good many tasks fall to their lot that require considerable technical skill.

Everything they do requires technical administrative ability. Occupation-army engineering cannot be catalogued in any familiar fashion. It is something new and evolutionary.

In the beginning, after VE-Day, true military engineering continued for some months. New bridges were built, Bremen harbor facilities were reconstructed to receive ships, roads were repaired and camps and barracks were established throughout the zone assigned to U. S. occupation.

Then came redeployment; everything stopped, everybody went home or awaited word to go; young, inexperienced troops came in as replacements, and a generally chaotic condition prevailed. Engineer officers who went through this period look back upon it as one of the most frustrating experiences of the war.

Relative equilibrium, however, was eventually achieved, and the phase that is still in progress began. Broadly, the engineer mission is to provide the facilities that will assure safe and comfortable living for official American personnel in Germany, civilian as well as military; and to keep open and operating the lines of supply by rail, road and water. A corollary of these tasks is to aid German reconstruction as much as possible within the framework of the wise policy laid down by General Lucius Clay—the distinguished Engineer officer who is the U. S. military governor and the chief of the European Command—to the effect that the Germans must do all the actual work themselves, and pay for it out of their own economy. In most cases of course, any help we give the Germans is a direct aid to our primary mission.

Occupation-army engineering is headed by Brig. Gen. Donald Shingler who, about a year ago, replaced Maj. Gen. Cecil R. Moore, chief engineer in Europe throughout the war and now retired. General Shingler has a fine background of experience for the job in hand. During the Thirties he was assistant engineer commissioner of the District of Columbia in charge of the extensive public building program in Washington. Early in the war he went to the Middle East where he organized and ran the motor transport service of the Persian Gulf Command. Finally, he was in command of the Special Engineer Brigades that spearheaded the Normandy landings and established the effective supply facilities on the beaches.

General Shingler has a staff of regular army engineers, each a specialist in the division that he heads, and there are area engineers, with their own staffs, located throughout our zone of occupation. What he does not have, although he did not say so, is enough troops and non-commissioned officers. Those that he has are for the most part inexperienced in engineering and construction, although they are learning, and the recent arrivals, being enlistees in the regular army, are anxious to make good.

Much of the troop organization is in the form of so-called Engineer Composite Groups that include service companies that operate and maintain the utilities of our installations, depot and maintenance detachments, dump-truck companies, construction companies and other specialist units. There are also labor service units of displaced persons who work under our supervision, and we also hire German labor and use German white-collar civilians.

Perhaps the major task, after housekeeping, relates to depots for surplus military equipment and supplies, and it is here that the lack of personnel shows up. The mountains of material that must be collected, inventoried, protected and turned over to the Foreign Liquidation Commission or otherwise disposed of beggars description. When it takes as much as 18 months just to find out what a given depot contains—and this applies not only to Engineer depots but to those of the Signal Corps, the Air Forces and all the others—an increase in personnel would seem to be a definite requirement.

Instead of waiting and then conducting a critical inquisition Congress might well examine its own present responsibility for this state of affairs. An alternative would be to accept the idea that the cost of our surplus supplies has already been accounted for in the cost of the war and to forget it since, dollarwise, the return will not be great anyway, and it may cost more to dispose of the materials than to give them away.

These observations represent a personal opinion and do not reflect any statements made by the officers of the European Command. They are soldiers, and attack the job at hand with whatever is available. It cannot, therefore, be said that progress is lacking.

There are now only five engineer depots in Germany, and four of these are being closed out as rapidly as possible so that everything can be concentrated in a main working depot at Hanau near Frankfort.

The initial difficulty caused by the quick redeployment at the end of the war when trucks for example, were just driven to some designated field and abandoned has largely been overcome. All such depots in France and Belgium have been cleared of equipment and materials that the Army needs, either in Germany or the U. S., and the residue turned over to the F.L.C. for sale. In Germany, as stated, all but five others have been likewise closed out. The great trouble is that supplies are brought into the remaining depots almost daily from small collection points, while other supplies move out, making inventorying difficult and time-consuming.

Contrary to a general impression, most of the construction equipment left over from the war was worn out—"battle weary" is the usual term. The good machines are reserved for our use in Germany or are being sent back to the U. S. in accord with a list of requirements set up by the War Department in Washington. Subject to shipping accommodations, these latter requirements are being met in full. The other machines are turned over to F.L.C. for disposal, and foreign buyers are anxious to get them, to cannibalize good parts that will create a few usable machines.

Aid to the Germans takes several forms. We may, for example, need some furnaces or water heaters for the homes of American personnel. The German manufacturers can supply them if we will get them some steel. Armed with a "hunting license" in the form of a priority for a certain amount of steel allocated by the Office of Military Government to the Army, engineer officers set off to round up the necessary material. Sometimes it is a product that is in our depots, and this can be quickly supplied—steel, lumber, lead and paint are not easy to find.

At the other end of the scale is a

(Continued on following page)

***Housekeeping**—Part of the U. S. Army's "housekeeping" job in Germany is the removal of debris from navigation channels of the Rhine River. Here three cranes attempt to raise a sunken barge for a two-fold purpose—to clear the channel and to salvage the barge for further use in transporting river freight.*

bridge. The idea for a given structure may originate with the Germans or we may initiate it. In either case we must approve the German design before it can be undertaken—a decision that it usually based on the availability and conservation of material—and then we often have to help the contractor in securing his necessary supplies and equipment.

An exception to our letting the Germans do all of their own work occurred recently on a bridge on the autobahn near Pforzheim between Stuttgart and Karlsruhe.

Needed badly on our communication lines and by the Constabulary, the bridge was built by a German contractor but with the active aid of men and equipment from the 333rd Special Service Regiment (now the 555 Composite Service Group) under Col Heath Twitchell and his chief construction assistant Carl Addison, formerly, with Merritt, Chapman & Scott. Consisting of four deck truss spans, it is supported by so-called "pendulum piers"—braced bents 90 ft. high hinged at the bottom. It carries a 20-ft. roadway and sidewalks, all assembled from precast slabs weighing as much as 6 tons.

Included in the job was stabilizing one of the stone arches in the approach that did not fall when the rest of the bridge was demolished. This was done by a set of cables running diagonally from the top forward end of the span to an equalizing beam placed behind the base of the pier at the back end of the span.

The reinforced cables passed through holes drilled in the pier and were prestressed by jacks reacting against the equalizing beam. The whole job was a major operation in conception, execution and supply, and gave the regiment a taste of real engineering and construction.

Incidentally, this structure has been named the Bunsen Bridge after the German chemist who invented the famous Bunsen burner. Naming these new bridges for German scientists was decided on in the hope that the names would not immediately be changed when the occupation ends, as they would be if we called them after some of our own people.

A nice twist is the naming of one structure for John A. Roebling. The Germans profess to be proud of him—even though he was really an American when he made bridge-building history.

More than a year ago the 333rd Special Service Regiment built the 3,900-ft. General Marshall Railroad Bridge and the 1,972-ft. General Patch Highway Bridge across the Rhine at Mainz, doing even more of the work themselves. These are fine examples of temporary military bridges—the best built over the Rhine—but they are scheduled for replacement this year by more permanent medium-term structures with greater shipping clearances. These new bridges will be handled in the usual manner—built to German designs by German contractors, aided only with advice and material priorities by the U. S. Engineers.

An agreement was recently reached with the French that we will be responsible for the construction and maintenance of these two Mainz bridges as well as the military highway bridge at Mannheim, also to be replaced. The French will take responsibility for all other bridges in the section of the Rhine that divides the U. S. and the French zones. None of the U. S. zone, it may be noted, includes both banks of the Rhine at any point, so that we actually have had jurisdiction over only one end of any of the bridges across the Rhine.

Now and then other interesting engineering jobs arise. One of these involved the design of warehouses at our depots. Desiring to provide as long spans as possible, the engineers hit upon the idea of using Bailey bridge units as roof trusses. The warehouses are 100-ft. wide, and one row of columns was placed down the center. A toggle connection between the top chords of the Bailey units over the columns permits them to be sloped toward the eaves for drainage. A slope of about 1:20 is provided. The trusses are spaced at 16 ft. centers longitudinally, and rest on exterior walls of concrete block or timber. About 500,000 sq.ft. of such enclosed storage space is being built at one depot at the present time.

But the job which will probably be longest remembered is a night club at Garmisch-Partenkirchen, the famous resort in the Bavarian Alps where the Olympic skating championships were held before the war and which is now a rest center for American personnel. Equipped with a movable floor to transform the dance floor into a skating rink and a movable roof to accommodate activities to the weather, Casa Carioca makes New York night clubs look provincial. In Spanish architecture, with Germany's highest peak—the Zugspitze—as a backdrop, it gives the patrons sitting at tables on the terraces, rising in a horseshoe curve around the arena, their money's worth, and then some. The cover charge is fixed at 50 cents.

When Maj. Frank Gammache dreamed up this exotic layout he justified once and for all the Garmisch Engineering Section, and gave it a job to do that it will not soon forget. Everything that went into the setup was scrap. The basis was an abandoned Nazi speed skating rink that was never completed, but contained the necessary piping and refrigeration. Brick, some 127,000 of them, came from the barracks in a nearby German army kaserne, structural steel and glass from old airplane hangars, the winches to move the floor and roof from U. S. army 6-ton prime-movers, the gears from old diesel locomotives and other parts from similar sources.

The wood floor, 45x33 ft., is pulled back under the main building by a 3-hp. motor when the ice show starts. The roof, 85x80 ft., weighs 120 tons and is operated by a larger motor, 3½ hp. Not only is the club a masterpiece of salvaged material, but because of the use of such scrap parts, it cost only $26,000. Cheap enough, particularly considering value of such an establishment.

From housekeeping to junk collecting, from bridge-building to night-club construction, occupation-army engineering comprises an amazing assortment of tasks. Chameleon-like it changes its appearance to suit the terrain, climate and conditions of the moment. But always it moves in the direction of supplying our occupation forces with the facilities they need to make them effective in running our zone of Germany. It is an important new field of Army engineering and it is being efficiently pioneered and developed.

OBITUARY

John Hunter Hanna, civil engineer and chairman of the board of directors of the Capital Transit Co., Washington, D. C., died in that city June 28. Following graduation from Princeton University in 1892 with a degree in civil engineering, he worked as an engineer on railroad construction in Kentucky, and on Feb. 21, 1894, he joined the engineering staff of the Washington-Georgetown Railroad Co. When the Rock Creek Railway and the Washington and Georgetown Railroad were reorganized into the Capital Traction Co., Mr. Hanna served as assistant chief engineer and superintendent, chief engineer, vice-president in charge of operations and then president. When the Capital Traction Co. and the Washington Railway and Electric Co. were merged in 1933 as the Capital Transit Co., Mr. Hanna was elected president, a position he held until March, 1937, when he became board chairman.

Roy M. Young, 55, district engineer at Lincoln, Neb., for the Civil Aeronautics Administration, died recently while on a vacation at Galveston, Tex. A civil engineering graduate of the University of Nebraska in 1916, Mr. Young was at one time with the Nebraska and Iowa state highway departments, and joined the CAA in 1932.

Francis H. Fay, 59, civil engineer for the Los Angeles county flood control district, died at Los Angeles June 13. A native of Los Angeles, Mr. Fay had held positions with the city and county organizations as well as with the Los Angeles Railway Co. and the Foundation Co. of New York. Since joining the county engineering department in 1922, he had been senior civil engineer, design engineer, chief hydrographer and finally civil engineer, grade 11.

Brayton A. Alderman, 57, engineer of plans for the Georgia Highway Department, died June 26 in an Atlanta hospital. Recently awarded a certificate of merit by the American Association of State Highway Officials, Mr. Alderman had been with the department since 1921.

Percy W. Miller, assistant engineer for the Syracuse, N. Y., Transit Corporation, died recently.

Michael Zarella, 46, a civil engineer in the Philadelphia district office of the Corps of Engineers, died recently at Drexel Hill, a Philadelphia suburb.

Paul O. Bair, 62, a member of the Spokane, Wash., general contracting firm of Roy L. Bair Co., died in Spokane June 21.

Seek Congressional OK on pollution pact

Congressional approval of an interstate compact for the control and reduction of pollution in the waters of New England states is sought in a bill now before the U. S. Senate.

Introduced by Senator Baldwin of Connecticut, the bill would give federal sanction to an agreement already ratified by the states of Connecticut, Massachusetts and Rhode Island covering interstate and tidal waters. The compact would create the New England Interstate Water Pollution Control Commission, staffed by five members from each signatory state, empowered to employ a professional engineer-secretary and to establish "reasonable" physical, chemical and bacteriological standards of water quality for various classifications of use.

Each signatory state would agree to establish programs of sewage and industrial waste treatment that will meet the standards set up by the commission. The states would supply some of the funds for operation of the organization.

Anti-pollution measures win in Rhode Island

Rhode Island voters by a 15 to 1 ratio in a special election on June 24, authorized the issuance $5,000,000 in bonds to finance creation of a Blackstone Valley Sewer District, which includes the building of a plant to process the sewage of Central Falls, Cumberland, Lincoln and East Providence.

An extended sanitary study of the state will be carried on this summer.

MAJOR MEETINGS

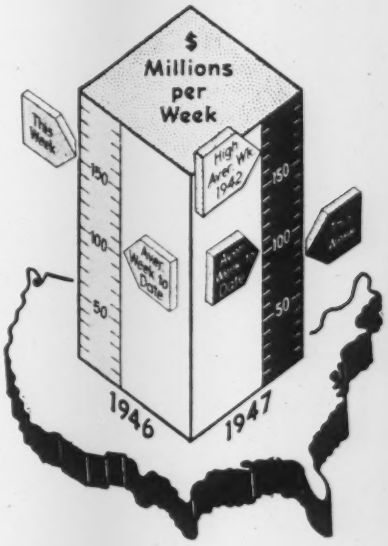
American Society of Civil Engineers, 75th annual summer convention, Hotel Duluth, Duluth, Minn., July 16-18.

American Water Works Association, 67th annual conference, jointly with Federation of Sewage Works Association, 20th annual meeting, Civic Auditorium, San Francisco, Calif., July 21-25.

Federation of Sewage Works Associations, jointly with American Water Works Association. See above.

American Congress on Surveying and Mapping, 7th annual meeting, Statler Hotel, Washington, D. C., August 14-15.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of July 10 1947	Cumulative 1947 (28 wks)	Cumulative 1946 (28 wks)
Federal	$13,733	$375,708	$390,695
State & Mun.	34,887	879,569	708,137
Total Public	$48,620	$1,255,277	$1,098,832
Total Private	30,070	1,602,877	1,807,459
U. S. Total.	**$78,690**	**$2,858,154**	**$2,906,291**

WHERE CONSTRUCTON ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (28 wks)	Cumulative 1946 (28 wks)
Waterworks ..	$1,341	$59,359	$51,624
Sewerage	2,700	69,704	49,498
Bridges	2,600	87,081	68,344
Highways	19,741	423,499	406,830
Earthwork, Waterways ...	6,985	173,556	230,093
Buildings, Public	12,895	292,091	193,679
Industrial ..	10,541	409,764	563,515
Commercial .	15,179	941,308	1,132,439
Unclassified ..	6,708	401,792	210,269

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (28 wks)	Cumulative 1946 (28 wks)
NON-FEDERAL	$62,752	$565,697
Corporate Securities	46,414	203,131
State and Municipal	16,338	362,566
FEDERAL	.....	158,320
Total Capital.....	**$62,752**	**$724,017**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	July '47	406.52	195.41
Building Cost	July '47	304.87	164.80
Volume	June '47	276.	121.

EDITORIALS

VOLUME 139 NUMBER 2

July 10, 1947

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ENGINEERING NEWS-RECORD is a consolidation of Engineering News and Engineering Record, effected in 1917. The Contractor was consolidated with Engineering News Record in 1918. Engineering News was founded in 1874 as The Engineer and Surveyor, which title subsequently became The Engineer, Architect and Surveyor, Engineering News and American Railway Journal and finally Engineering News. Engineering Record was established in 1877 as The Plumber and Sanitary Engineer. Subsequently it became The Sanitary Engineer, Engineering and Building Record, and, finally, Engineering Record. All rights to the above titles are reserved.

Water and Sewage Treatment Advances

CHANGES portending significant departures from orthodox practice in water and sewage-treatment plant design are revealed by articles in a special section of this issue. These developments are an auspicious, but not an unlooked for, element of the postwar revival in municipal construction activity, which is now getting under way. From these articles we note, for example, that practical operating experience at Chicago indicates the feasibility of water filtration at twice the rate hitherto considered feasible. And at Philadelphia the waterworks engineers have contracted for the installation of the world's largest ozone generator for the control of tastes and odors. In the sewage-treatment field, interest centers on two novel developments. One of these is at the Puyallup, Wash., plant, where concrete-embedded pipes for heating sludge will provide opportunity for demonstration of the principles of radiant-heat transmission. Another development relates to the design of clarifiers and trickling filters, single units of which will perform dual functions and thus minimize construction costs. All of this is heartening as we enter what promises to be the greatest era of sanitation-works construction ever witnessed.

Taft-Hartley Act and Costs

SEVERAL PROVISIONS of the Taft-Hartley act hold promise of providing the means for achieving some reduction in construction costs. These are the sections that: (1) rule out "exactions" for services not performed, thus proscribing featherbed practices; (2) give management the sole authority to say who shall do certain types of work, thereby establishing a barrier to jurisdictional strikes; and (3) prohibit boycotts or so-called secondary strikes. How potent these three factors can be in creating unnecessary costs on construction operations was analyzed in the pages of this journal recently (May 29, vol. p. 881). Here, for example, was recited a dramatic example of featherbedding in which it cost $1,308 weekly for three mechanics on a 24-hr. basis, simply to "stand by" on a temporary steam-heat installation in a building under construction. Hardly a week goes by that the news pages of this journal do not carry stories of major projects being shut down because of jurisdictional disputes or secondary boycotts. Curtailment of this economic waste, which seems possible under the Taft-Hartley act, should benefit those who buy as well as those who sell construction services.

Independence for Professionals

OTHER PROVISIONS of the Taft-Hartley act assure independence to professional employees. Now they cannot be compelled to accept collective-bargaining representation by a union in which they have little voice. However, they can join with such a union if the majority so vote, or they have the choice of asking some other organization to represent them, of setting up their own collective-bargaining group, or waiving the right to collective action. And the act appears to give engineers, who in the past were grouped with other employees by the National Labor Relations Board, the right to cut loose from the others if they so desire. Another important provision of the new act is its definition of professional employees, which includes the engineer-in-training with the professional group. These amendments to the National Labor Relations Act mark a long forward step toward assuring independence to professional employees in their relations with their employers while still protecting their right to collective action when that becomes necessary. Most of the credit for getting these provisions written into the bill as finally passed should be extended to the American Society of Civil Engineers.

Cutting Right-of-Way Costs

WITH the increasing demand for expressways through built-up urban areas, means for reducing the cost of rights-of-way for such expressways assume added importance. That fact gives special significance to the account on page 104 of this issue of how land acquisition costs were cut when buying right-of-way for the Chicago-Detroit Expressway through Hammond, Ind. Moving the 102 houses was let as a single contract, thus permitting organization of the work on a basis that

insured both speed and lowered cost, and all the FHA mortgages on the properties were purchased by a local bank. This latter arrangement greatly reduced the work of final transfer of the property to the state and simplified the issuing of new mortgages on the relocated houses. Large savings in time and legal work were made and it is believed that very material savings in total cost were realized over a plan under which each property is treated separately.

Slightly Ahead of Their Fellows

TWO STATEMENTS noted recently in the diverse reading that is one of an editor's duties and at the same time a continuing source of inspiration warrant thoughtful consideration by engineers, especially the younger men, many of whom are starting their professional career at this time of the year.

The first comes from V. J. Wilmoth's *Civil Engineering—A Career.*

> It is the fellow who is always slightly ahead of his fellows in his ideas, rather than the Michael Angelo who is centuries ahead, who leaves his mark—anyway in the contemporary world.

And the second was made by W. F. Luder and S. Zuffanti in their preface to *Electronic Theory of Acids and Bases.*

> A new theory, in order to be convincing, must not depart too far from previously accepted ideas.

It may be said in criticism of both these statements that they are overly cautious, a denial of the pioneering spirit with which a young engineer should be fired. However, we do not cite them with any such connotation in mind. Rather, we see in them emphasis on the desirability of always being on the lookout for ways of improving current practices or design procedures. Thus the daily task can be converted from a tiresome routine to a field for fruitful exploration. With this approach, the frontiers of scientific advancement are brought close to hand instead of being far afield.

These observations concerning new ideas carry other lessons of special value to the young engineer. First, don't be discouraged by the cool reception that may be accorded some proposal you may make that appears to you to be very important. Engineers as a group are conservative. They look with questioning eye at any proposal that "departs too far from previously accepted ideas". Certainly that is true of the civil engineering profession in this country where it is rare indeed to find the boldness that characterizes the design methods of many European and Latin American engineers. Part of this conservatism may be due to economic conditions, for our engineers are not under the same pressure to cut costs as are those in other countries.

And the second lesson may be said to be the need for careful marshalling of all supporting data when you have a new idea to put forward. If you have a proposal that does depart radically from accepted ideas, its acceptance or rejection may turn on your ability to present it convincingly.

A few of the outstanding scientific men of today owe their position to some stroke of genius, but the great majority of those whose advice is eagerly sought are in positions of leadership as a result of consistently being slightly ahead of their fellows in determining the routes by which scientific or engineering progress is to be made.

Trends Toward Cost Stability

HEAVY-CONSTRUCTION labor organizations in New York City and the contractors with whom they work reached a new high in labor contracts when they agreed, effective July 1, to "freeze" wages at current scales and to work a uniform eight-hour day for the next 2½ years (*ENR* July 3, vol. p. 1). Absent from this contract are the usual escape clauses that brought earlier agreements to naught, such as permitting the signatory unions to ask for more money if other workers get more. The new wage agreement was entered into to stabilize the major element of uncertainty in construction costs, thus helping contractors to reduce the factor for labor contingency in their estimates.

Another stabilizing influence in construction costs—this one of national significance—is the trend toward firm-price quotations from equipment and materials suppliers. This situation has resulted, in part, from the announced intention of many purchasers to favor only those suppliers who quote firm prices. These examples of local and national efforts toward stabilization of labor and material costs may be expected to have a salutary effect on construction prices.

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Fig. 1. Cross-lot bracing and inclined timber shoring protect the 400 x 900-ft. open excavation for Terrace Plaza Hotel.

Deep Building Excavation in Cincinnati Required a Bold Design of Cross-Bracing

Alonzo D. Quinn
Moran, Proctor, Freeman & Mueser, Consulting Engineers
New York City

***Contents in Brief**—Excavation for the Terrace Plaza Hotel building in Cincinnati, Ohio, which extended a maximum of 55½ ft. below street level, required bold planning of cross-lot bracing to prevent settlement of adjacent streets and buildings. One large building required extensive underpinning while another was prevented from subsiding by the installation of steel sheet piling with prestressed cross-lot bracing and horizontal prestressed steel girders reacting against the building frame.*

ONE of the deepest building excavations ever made in Cincinnati, Ohio, was that required for the 18-story Terrace Plaza Hotel building, now under construction between Vine and Race streets, on Sixth St. The main building (Fig. 2) is 400 ft. long and 90 ft. wide with a 9-story annex located on the south side. Thorpe Alley, which is to be maintained, passes through the annex that bridges the alley at the second floor level. The first seven stories of the building will be devoted to commercial enterprises —the upper eleven floors to the hotel proper.

In the fall of 1945 while preliminary plans were being formulated for the construction of this building, a boring contractor drilled nine test holes to obtain samples of the underlying soil. Two holes were drilled to a depth of 150 ft. below street level without striking rock, while the remaining seven holes were stopped at a depth of 100 ft. in a gray nonplastic silt formation.

The borings disclosed sand and gravel formations of good bearing value at the subgrades required for

the lowest basement levels. Samples of the sand were submitted to the Cincinnati Building Department and a safe bearing capacity of four tons per square foot, as recommended by the engineers, was approved.

Observations on water levels in the test holes showed water to be a considerable distance below the deepest excavation. The highest flood level of record in the Ohio River at Cincinnati occurred on Jan. 26, 1937, when the river rose to El. 509.3 or about 6½ ft. above the level of the boiler room floor. Because of the open formation of the sand and gravel beds and the possibility of future floods in the Ohio River raising the water level at the site of this building, the boiler room slab and retaining walls were designed to resist water pressure.

Preliminary estimated column loads indicated that the building could be supported on spread footings which in some areas would need to be combined into footings or mats supporting several column loads on one foundation. The heaviest column dead and live load for individual footings was about 1,300 tons which, combined with wind load and weight of footing, gave a total foundation load of more than 1,800 tons, requiring a footing 21 ft. 6 in. square and 5 ft. 9 in. thick.

The east half of the building has a basement and a sub-basement floor with the latter resting on ground at a depth of about 30 ft. below street level. The west half has an additional floor about 50 ft. below street grade which serves as the boiler room and fuel storage space.

Exterior foundation walls below street level are reinforced concrete. They are designed as retaining walls to resist earth pressure and, in the boiler room, water pressure during extreme high water resulting from flood conditions in the Ohio River. In addition, the exterior wall along Thorpe Alley supports the exterior columns of the building. Along the other three street fronts the columns are set back from the building lines 6 ft. 6 in. on Sixth St. and 10 ft. on Race and Vine St., and the column loads are carried on spread footings at the lower basement levels.

Cost-plus-fixed-fee contract

The necessity of ordering construction materials at as early a date as possible made it essential that a contract be let for the construction of the building, including the foundations, without waiting for completion of final plans. Consequently, a general contract for the entire construction was let to a local contractor on a cost-plus-fixed-fee basis.

A demolition contract also was let for wrecking the existing buildings to street level. This work was completed on Jan. 1, 1946, at which time the building contractor commenced the excavation and foundation work.

With preliminary excavating and bracing plans developed by the engineers, the architects and their consulting engineers met with the builder and reviewed the construction procedure for building this foundation.

The excavation work was unduly complicated by the narrow 10-ft. alley which had to be maintained between the south building line and the adjacent property. This property includes the Grand Theatre building extending from Vine St. 224 ft. along the alley; an old 22-ft. wide, four-story building; and the Woolworth building for the remaining length of 107 ft. to Race St.

The protection of these buildings required either the underpinning of,

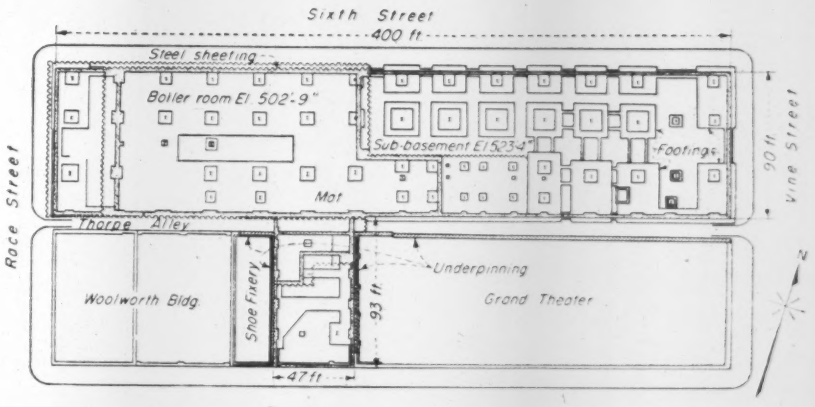


Fig. 2. Steel sheetpiling in the boiler room area was left in place to form the foundation walls. Maintaining Thorpe Alley as a walkway, and the close proximity of two large buildings, aggravated the problem of foundation excavation.

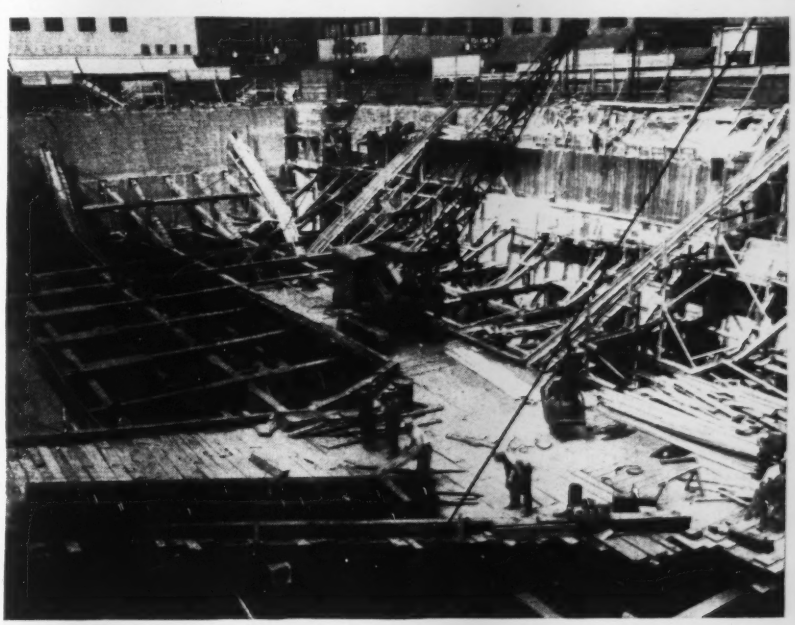


Fig. 3. Cross-lot bracing in the deeper portion of the excavation was massive and complex. Excavation was by crawler crane and haulage by dump trucks, up a timber ramp.

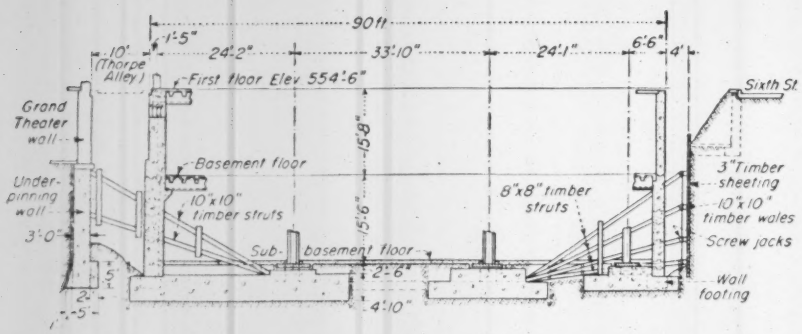


Fig. 4. Underpinning for the Grand Theater was braced to previously-poured column footings by timber struts extending through the south wall. Timber sheeting behind the north wall was similarly braced.

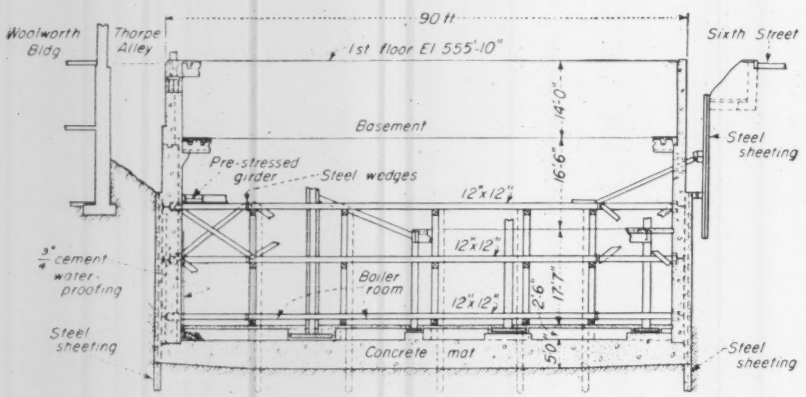


Fig. 5. Three-tier, cross-lot bracing in the boiler room was supported on previously driven timber piling, with the center and lower lines of struts being installed as the excavation progressed.

their exterior walls, or the use of steel sheetpiling and cross-lot bracing to retain the sides of the excavation for the new building. A combination of these two methods was approved—the Grand Theatre and Shoe Fixery building were underpinned alongside Thorpe Alley (Fig. 1) with a continuous concrete wall, constructed in short sections, to a depth approximating the subgrade elevation of the new building.

Steel sheetpiling for the deep area

The Woolworth building was not underpinned. Its foundations are some 25 ft. below grade, and are located opposite the deep section of the boiler room (Fig. 5). It was decided to use steel sheetpiling around the boiler room excavation and to brace it with steel walers and timber cross-lot bracing of adequate strength to support both the earth pressures and the additional surcharge pressure resulting from the weight of the Woolworth building.

In general, the excavation procedure was first to remove the old building foundations and debris left by the wrecker, down to the old basement levels. A cut was then made by a power shovel down to El. 523 (sub-basement floor) leaving an earth bank along the streets and Thorpe Alley. Upon completion of the excavation at the east end, short lengths of light-weight corrugated steel sheetpiling were driven for the interior spread footings, and the footings excavated and concreted.

The next step was to install sheeting along the street building lines, using 3-in. wood sheeting at the east end and steel sheetpiling at the west end, and to excavate progressively and brace this sheeting with inclined timber shores reacting against the large interior concrete footings at the east end.

The combined footings along Thorpe Alley, in front of the Grand Theatre, were sheeted and excavated one at a time, to maintain adequate lateral support for the underpinning wall under the theatre. After concreting a combined footing, timber shores were placed against the underpinning wall (Fig. 4) and the footing utilized as a sill for the struts to bear against. Adjoining footing could then be excavated and the process repeated.

Installing the cross-bracing

While the above work was going on at the east end, the upper tier of steel sheetpiling was being driven along Sixth St. and Race St. at the west end. The next step was to excavate the interior of the boiler room area to El. 523 leaving a wide berm to support the sheeting along Sixth St. A second line of heavy steel sheetpiling (Fig. 5) was then set up and driven to completely enclose the boiler room area to a depth below the lowest footing in that area, the piling along Sixth St. being first driven below the top of the berm to clear the bracing for the upper sheeting. While the second line of sheeting was being driven, the top tier of cross-lot bracing was installed and the upper steel sheeting along Sixth St. was then braced with inclined shores reacting against the top tier of bracing. Following this the berm was removed, the steel sheeting along Sixth St. driven to its final depth, and the top tier of bracing extended to support the sheeting. Excavation was continued to the underside of the second tier of cross-lot bracing; the bracing was installed and the process repeated to place the third tier of bracing.

All cross-bracing was stressed by means of steel wedges as it was installed. Once the lower bracing had been completed and sufficiently stressed by wedging to take the earth pressures from the surrounding banks and surcharge of the Woolworth building, the excavation proceeded to the subgrade levels and the concrete mat was poured.

All wedging was performed with pairs of steel wedges inserted between steel plates which bore against the ends of the timber struts. The timbers were prestressed by wedging before the earth pressure came on the struts. This prevented an inward movement of the sheeting which otherwise would have taken place from shortening of the struts. During the job, as long as the bracing was supporting the sides of the excavation, the contractor

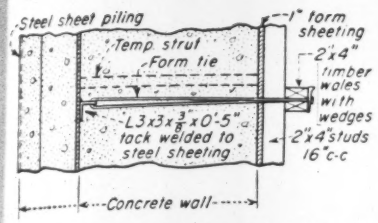


Fig. 6. Clip angles tack-welded to steel sheetpiling, together with double form-ties, held the interior forms for the foundation walls securely in place.

followed a routine procedure of inspecting all wedges and doing additional wedging required to keep the timbers properly stressed.

The tops of the footings and the structural slab in the boiler room area were located 2 ft. 6 in. below finished floor to furnish space for underground piping. This space was filled with gravel to serve as a drainage course in the event of a leak in the cement-coat waterproofing which was applied to the entire interior surface of the boiler room.

When the footings and structural slab in the boiler room were completed the lower tier of bracing was removed, as the sheeting could then be supported at the bottom by the concrete footings and slab.

Floors form permanent wall bracing

Permanent lateral support for the exterior walls, in general, was furnished by the completed floors below ground level. However, for a distance of 84 ft. along Thorpe Alley, where part of the sub-basement floor was omitted to provide additional headroom for the boilers, it was necessary to install three, 28-ft. prestressed steel girders to carry the horizontal pressure from the wall to interior building columns.

The next step in the foundation work, after completing the footings, was the construction of the exterior walls. At the east end of the building, where the wood sheeting was approximately 4 ft. outside the building line, the walls were formed on both faces. Pockets were formed around the inclined timber braces to facilitate their removal, following which, the holes were filled with concrete.

At the west end, below sub-basement level, the steel sheeting formed the outer face of the exterior wall, and the wales, which were steel I-beams, were concreted in the wall. Pockets were formed for the timber struts which subsequently were removed. The upper part of the wall at the west end was constructed similar to that at the east end.

The utilization of the steel sheeting as the outside form for the exterior concrete walls around the boiler room led to the development by the contractor of a simple means of supporting the forms for the interior faces of these walls against the lateral pressure of the concrete. To provide this support the contractor welded 3x3x$\frac{3}{8}$-in. clip angles, 5 in. long (Fig. 6), to the steel sheeting. They were spaced 32 in. apart horizontally and 18 in. vertically. Each clip angle had a $\frac{3}{4}$-in. hole in the outstanding leg to which was attached a double form-tie supporting two 2x4-in. walers.

Upon completion of underground piping within the building, the floors which rest on the ground or on floor fill were concreted. Cement floor finish was placed later as a separate coat so that it would not be damaged by the building construction work.

After the steel-girder supports for the wall were prestressed the temporary cross-lot bracing was removed, and simultaneously the space outside the opposite side wall was backfilled with selected sand and gravel fill, well tamped to prevent any inward movement of the upper steel sheeting supporting Sixth St. as the braces were removed.

No settlement of adjacent buildings

The Woolworth building across the alley was kept under observation and no settlement has been reported to date. This indicates the care exercised in making an excavation 55 ft. below the street level within 10 ft. of, and 28 ft. below, the spread footing foundations of the Woolworth building. Any inward movement of the sheeting along the alley would almost certainly have resulted in a disturbance of the soil under the spread footings and a settlement of the building.

The foundation work for the Terrace Plaza Hotel building involved the removal of over 75,000 cu. yd. of earth, and the placing of 11,500 cu. yd. of concrete. For the sheeting and bracing of the sides of the excavation 490 tons of steel sheetpiling, 27,000 b. ft. of timber sheeting, 66 tons of steel walers and 310,000 b. ft. of timber bracing were used. These quantities give some idea of the magnitude of the job.

The foundation design was made, and field supervision provided, by Moran, Proctor, Freeman & Mueser, consulting engineers, New York City, who acted as foundation consultants to the firm of Skidmore, Owings & Merrill of New York City and Chicago, architects for this project. Weiskopf & Pickworth, consulting engineers, New York City, were the structural engineers for the building. Frank Messer & Sons, Cincinnati, is the general contractor for construction of the building, including the excavation, and Thomas Emery's Sons is the owner.

Stream Sanitation Aided by Phenol Recovery

In a paper read before the American Chemical Society at its recent meeting, Herbert A. Gollmar of the Koppers Company, Inc., Pittsburgh, declared that sulfur and phenol, the most objectionable of the waste products of the coke industry, are now being recovered in commercially important amounts.

Phenol has caused trouble in streams used for city water supplies because it intensifies the unpleasant taste of the chlorine added for sterilization, he explained. Processes have been developed recently for removing phenol from coke waste and for recovering it for use in the plastics industry.

The presence of excessive amounts of sulfur in coke-oven gas is becoming more of a problem, since better coals of low sulfur content are becoming scarce. One process in general use recovers the bulk of the sulfur as a wet paste. This product is readily sold for fruit tree spray and for other agricultural uses.

A new process, also in commercial use, recovers the sulfur in the form of sulfuric acid, it was reported. Large amounts of sulfuric acid are regularly consumed by coke plants and steel mills. Therefore, this new process serves the combined purpose of eliminating sulfur-bearing wastes, improving the gas for steel-making purposes, and making the industry independent of outside sources of sulfuric acid.

A Greater London is Planned

A NOTABLE PLAN of city and regional development for London is being rapidly brought to definite purpose by British government authorities. Approval in substance of the Greater London Plan outlined in 1944 by Prof. Sir Patrick Abercrombie is announced by the British Ministry of Town and Country Planning. This approval is based on a favorable review of the Abercrombie plan by an Advisory Committee for London Regional Planning established by the Ministry in 1945. The advisory committee worked through a technical subcommittee, which analysed the plan in detail, and reported in 1946 minor changes but wide adherance to all main elements of the plan. These are:

1. Division of the regional area into four roughly-circular zones of rings centering at Charing Cross in the City of London.

2. Planned decentralization of population and industries from congested inner rings (particularly the County of London) to outer rings by expansion of existing towns or building new towns in outer rings.

3. Expansion of public services (gas, electricity, water supply, sewerage, etc.) concurrently with redistribution of population and industries.

4. Improved communications, especially an inter-ring road system, but also airports, waterways and railways.

The zone system

As indicated, the main structure of the Greater London Plan is designed to give effect to a general policy of decentralizing population and industry from the congested districts in the County of London and on its outskirts and regrouping them in planned communities outside a wide green belt surrounding the suburban fringe. To this end it consists in dividing the region into four "rings" as shown by the map. These rings are:

1. *The Inner Urban Ring* which comprises the fully built-up areas adjoining the County of London. Many districts in this zone, on account of war damage, overcrowding, obsolete dwellings and lack of open space require replanning. For this it is estimated that decentralization of 415,000 people from the inner urban ring will be necessary. This total is based upon the proposed net densities of 100 and of 75 persons per acre for different parts of the zone.

2. *The Suburban Ring* which adjoins the inner urban ring and extends to a radius of about 12 miles from Charing Cross. This area is now built up to the limit prescribed by tolerable conditions and with regard to population and industry should be regarded as static. Some internal regrouping on the community principle is needed, including the building up of vacant frontages. Apart from this, further development should not be allowed in this zone for which an average net residential density not exceeding 50 persons per acre is recommended.

3. *The Green Belt Ring* which extends for about 5 miles beyond the suburban ring. It is still largely open country, but it includes several established centers of population. Only small increase in existing towns in the area, designed to create communities of reasonable size, are to be allowed. Otherwise new developments are to be rapidly excluded. The green belt ring is intended for the dual purpose of providing recreation for Londoners and preventing further suburban sprawl. It is not intended that all, or even a large part of the area, should be acquired by local authorities but many playing fields, recreation centers and other open spaces could be accommodated in it.

4. *The Outer Country Ring* which extends from the green belt ring to the boundary of the region. It contains distinct urban communities in land otherwise open in character and mainly agricultural. By the expansion of some of the existing towns and the creation of a few new satellite towns it is proposed to accommodate in this ring the bulk of the decentralized population.

Decentralization

The Abercrombie report (1944) called for the decentralization from inner rings of some 1,250,000 people; and then redistribution, with supporting industries, in the outer country ring or outside the London region. While concurring with the total figure of migration, the advisory committee held that a part of it could be to the green belt ring and none need go beyond the outer country ring. In respect to the committee's change of redistribution, the Minister of Town and Country Planning has said: "The report proposes the accommodation, within the green belt ring, of nearly 160,000 more people than suggested in the plan. The government have already declared their determination to safeguard this ring in order to stop the continued outward spread of London and I shall be generally unable to accept these expansions."

Adherence to the original plan of redistribution is thus forecast. In respect to decentralization, it is definite that it will be from the congested districts of the County of London and the inner urban ring. Of the total 1¼-million movement about 1-million will be mass decentralization and the remainder will be sporadic infilling. A postulate of all population movement is that provision of supporting industries and housing shall be concurrent. Concurrent replanning and opening up of congested areas is also an accepted requirement.

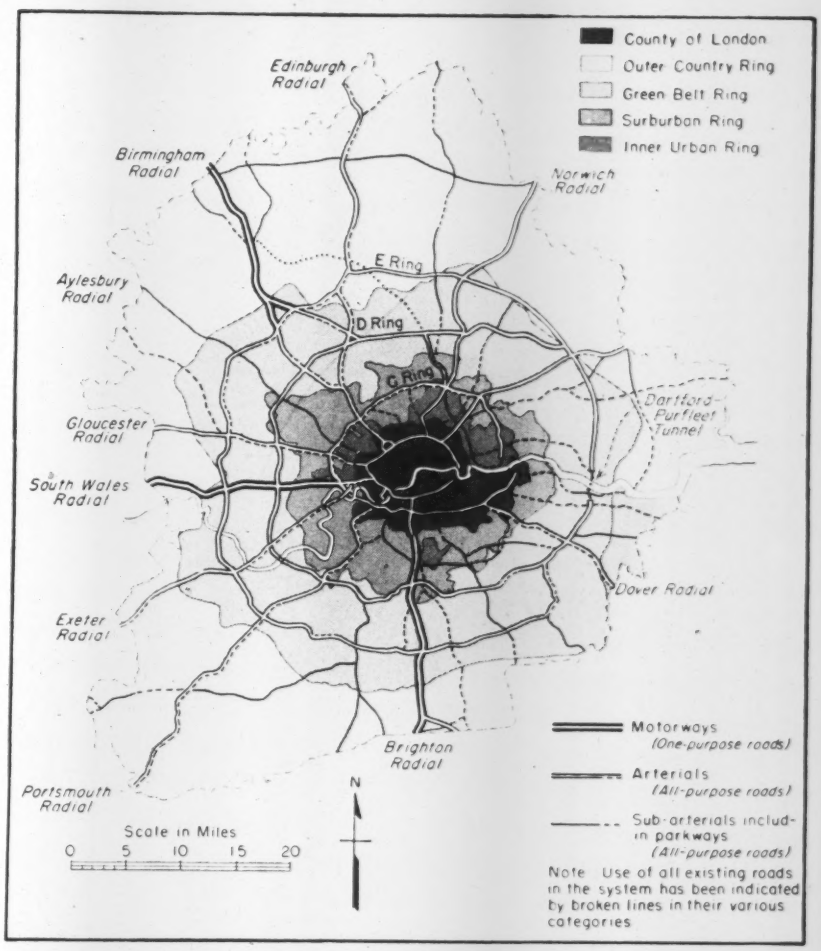
Communications

The Abercrombie plan stressed communications as a factor in executing its proposals. This development is emphasized by the advisory committee. Consideration includes airports, waterway wharfage, and railways but the emphasis is put on motor transport.

To provide interzone communication, the Greater London Plan contemplates a system of roads tentatively located as shown by the map. The main framework is an extension of the present County of London Plan which includes the A-Ring connecting the terminal stations, the B-Ring and the C-Ring as shown by the map. The D-Ring is an entirely new road on a circle at about 12 miles from the center of the city or about on the outskirts of the suburban zone. The E-Ring is a revised routing of existing orbital roads.

Ten main radial and various subradial roads interconnect the ring roads and connect the London area with Birmingham, Edinburgh, Dover, Portsmouth and other British cities. Three of the main radials, South Wales, Birmingham and Brighton, are designated as one-purpose or motor roads. Final determination of road purposes and other details rests in the Ministry of Transport, as is noted later, but the main road plan is likely to be unchanged. In general the map road system is accepted as final.

A substantial part of the road work will be reconstruction of existing roads. For the main radial and belt routes, however, reconstruction will add up to virtually new structure. Designs and construction will be to the standards of the Ministry of Transport and these are high in the scale of modern practice for trunk roads. The ministry has announced the preparation of instructions for the Greater London Plan.



Areas tributary to the densely populated County of London have been divided into four outer rings into which population and industries are to be moved under the decentralization plan now being put into effect.

Railway reconstruction planned

Improved railway transport will come through the billion dollar reconstruction operations of the London Passenger Transport Board. Independent in authority and direction, except as the Ministry of Transport has a part in both, from the Greater London Plan, the operations of the transport board are physically a part of the overall modernization of the British capital.

The work of the transport board, begun before the war, interrupted by hostilities and now resumed, is the unification of city passenger transport. The services included are the underground "tube" railways, the suburban passenger railways, the British trunk lines entering the city and the surface bus lines. Uniform tracks, power, signaling and rolling stock enable through running as desired, and new or enlarged stations provide direct passenger exchange elsewhere. Bus service is being changed to trolley-bus. The pre-war estimated cost was £45,000,000, but greater post-war costs and further proposed extensions will greatly increase this sum.

Open spaces

Provisions for open spaces in the Greater London Plan are lavish and drastic. As shown by the map, a five-mile open zone will encircle the city. In this zone future residence and industrial development will be rigidly restricted. A liberal development of play grounds, game fields, drives, foot paths, etc. is contemplated but for the most part the land will be left open and the natural scenery preserved. It will be the plan also to open corridors into and penetrating the other zones, particularly the inner zones.

Conclusion

Implementing the work outlined is a task of much time. The removal of 1¼-million people, with their supporting industries, from central London to places of residence and employment a score of miles distant is a social and engineering problem of gradual solution. The preliminary planning is now completed. The Minister of Town and Country Planning reporting as of Nov. 27, 1946 says: "The Abercrombie plan, together with the Advisory Committee's report, can now be taken as the general framework for planning in the Greater London Area."

Fig. 1. In case heavy trucks come down this 6 percent grade out of control the concrete deflector on the center line keeps them from cutting over into opposing stream of traffic.

Median Deflector for Sharp Curves

ENORMOUS freight tonnage is continually being trucked over the "Ridge Route," the main arterial highway between Los Angeles and the productive San Joaquin Valley to the north. The route is a mountainous one which climbs from near sea level to a summit elevation of more than 4,000. Thus, in rough terrain, it was not feasible to avoid long stretches of 4 and 5 percent grades that sometimes wind around rather sharp curves; there is one curved 5-mile portion of the route on which the grade is 6 percent.

Traffic passing over this steep grade now averages 6,500 vehicles per day of which 25 percent are trucks. Many of these trucks being in regular operation, for reasons of economy are loaded to near the legal limit. As these heavy loads come down the long 6 percent grade they do not depend on brakes alone, but use the gears extensively for braking. Hence, if a driver "misses" in shifting or if there is a break somewhere in the mechanism, a disastrous runaway may occur.

Trucks attain high speeds

When the former steel and wood guard-rail occupied the median strip it is reported that "speeding trucks or those out of control, habitually used the guard-rail as a rubbing strip to reduce speed. This constant scuffing and rubbing was extremely detrimental to the rail and consequently maintenance and replacement costs were excessive."

Motorcycle officers, on at least one occasion, clocked a runaway truck coming out of the lower end of this grade at 100 m.p.h. Under these conditions, and with a relatively high rate of fatal accidents, some special provisions for safeguarding the curving, 6 percent grade was highly desirable.

Therefore, to prevent serious head-on collisions and to do away with the metal-and-wood guard-rail that proved inadequate in this location, the California Highway Commission designed and is experimenting with a concrete "deflector" or median barrier. A 2,000-ft. length was installed last October. During the first six months the deflector withstood some heavy impacts, judging from marks left on the concrete, but in no case did a truck climb over the deflector into the lanes of opposing traffic and there were no fatal accidents on this part of the route. It is believed that the deflector has prevented accidents that very well might have involved fatalities.

The design of the precast units was worked out with a view to maximum strength in a hollow shape with

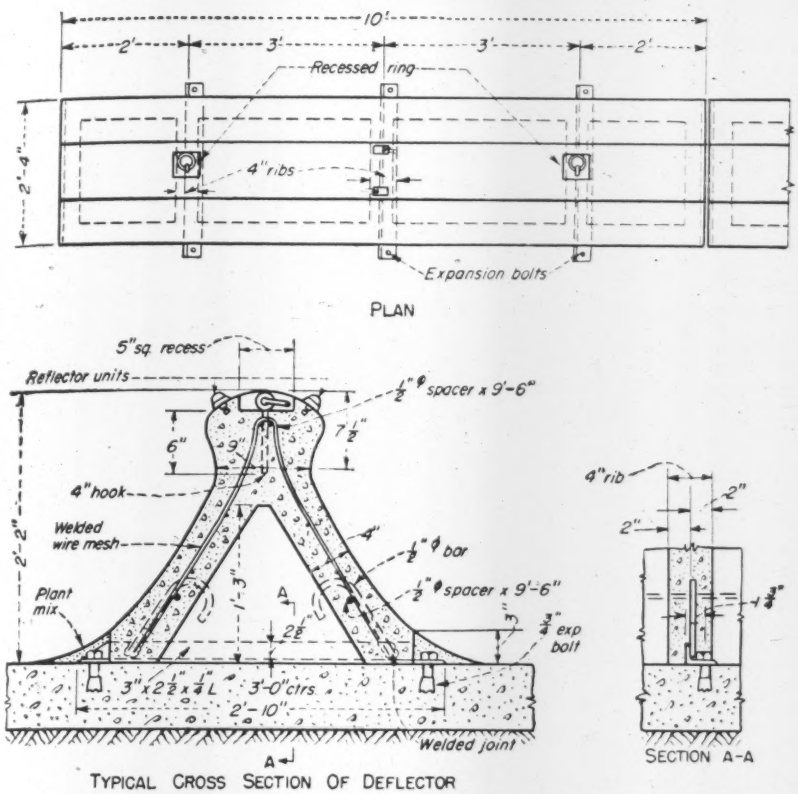


Fig. 2. Details of the hollow, precast concrete units, 10 ft. long and weighing about 3,000 lb. each, that were hauled in on trucks and bolted to the pavement.

smooth outer surfaces on which automobile tires could ride up easily from pavement level, thus warning the driver of his position by elevating one side of the car. Steel forms were used for casting to make the outer sides of the deflectors as smooth and slippery as possible.

Each unit has a minimum wall thickness of 4 in. and five transverse ribs also 4 in. thick. In the ribs 2 ft. in from the two ends are eyebolts used in lifting the unit. These eyebolts extend 6 in. down into the concrete and have a 4-in. hook on the lower end. The eyes, whose tops are flush with the top of the deflector are set in recesses, each 5-in. square which make it easy to attach the two hooks by which the unit is raised.

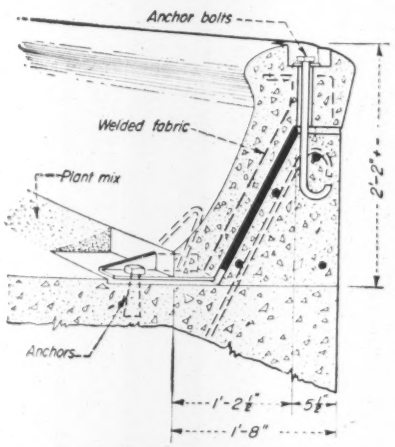


Fig. 3. Adaptation of the median deflector design that is now under consideration for outer curbs.

In addition to the wire mesh reinforcing (6x6-in. welded mesh of No. 10 wire), an angle iron is placed transversely across the unit in the bottom of each of the three central ribs and to each end of this angle is welded a ½-in. curved bar that bonds the angle into the rib above. The horizontal leg of each angle is drilled at both ends and through these holes ¾-in. expansion bolts fasten the units to the concrete pavement below. Half-inch spacer bars are used at top and bottom, as indicated in the drawing, to hold the steel in place during pouring.

Each section has a central "cat's-eye" reflector that reflects in both directions. The 10-ft. units are set in place ½ in. apart, longitudinally, and at the end of each one a 1x6-in. drainage indentation provides for escape of water that might otherwise accumulate on one side.

At the end of the deflector is a cast "special" whose shape is that generated by revolving half the deflector section about a vertical axis through an angle of 180 deg. This special gives a finished appearance to the end of the structure.

The deflector units were cast in 10-ft. lengths each weighing about 3,000 lb. Units of this size were conveniently handled by a trailer equipped with a derrick boom that could load the units in the casting yard and then set them accurately in place on the pavement after arrival at destination.

Now under consideration is use of a similar deflector on the outer edges of pavements where there is no shoulder and where serious accidents would result from over-running the pavement. The tentative design for this deflector is shown in Fig. 3.

The median deflector was built by the California Division of Highways, George T. McCoy state highway engineer.

All-Solids Fineness Modulus Simplifies Mix Design

The selection of batch proportions for concrete mixes where more than one cement content may be desired with a particular set of aggregates may be simplified by including the cement in the computations for fineness modulus. The combined modulus is essentially constant for all workable mixes, according to Myron A. Swayze and Ernst Gruenwald, director of research and manager Incor Division, respectively, Lone Star Cement Corp. (*Journal* of the American Concrete Institute, March, 1947).

The authors point out that when two or more aggregates are proportioned to give a combined modulus, the proportions should be in relation to the volumes they occupy in the mix, rather than to the weights they contribute to a given volume of concrete. Further, since cement is an essential ingredient, the volume it occupies in the mix must have an important bearing on the relative proportions of fine and coarse aggregate.

Typical of the houses to be removed are one-story brick veneer and 1½-story timber-frame dwellings.

The most expensive house to be moved is a two-story brick, valued at $30,000.

Mass House-Moving Cuts Cost Of Urban Right-of-Way

PURCHASING a million dollar's worth of right-of-way is a large order in any highway program—but when the property in question contains over 100 private dwellings ranging in value from $7,500 to $30,000, all of which have to be moved, and with most of the homes covered by FHA mortgages held by banks, insurance companies and other financial institutions in cities far removed from the construction site—the legal and technical aspects appear at first glance to present almost insuperable barriers.

Such was the case when the Indiana State Highway Department started negotiations in May, 1946, to purchase one mile of 300-ft. right-of-way, including that required for two large interchange connections through the residential section of Hammond, Ind.

There are 102 houses, in all, to be removed from the right-of-way on which will be built Indiana's first section of 4-lane divided highway on the Tri-State Highway which will form a part of the Chicago-Detroit Expressway. It will connect with a portion of the highway now under construction by Cook County, Illinois, at the Illinois-Indiana state line near 177th St., and extend one mile east. Subsequently the new construction will continue eastward about 19 miles to a connection with US Highway 20 leading to South Bend and Elkhart, Ind.

At this writing negotiations have been completed for moving to new locations, and transfer of the land to the state highway department, in the case of all but three of 72 houses which carry FHA-insured mortgages held by financial institutions in other cities. Negotiations for moving the 30 other homes, which are either free of debt or carry mortgages held by local institutions, also are nearly completed. None of the houses had been moved to date but contracts call for all to be moved by Sept. 1, 1947.

All FHA mortgages centralized

The crux of the entire problem lay in centralizing all FHA mortgages in one local bank—the Calumet National Bank. This plan, together with agreements made between the state, the home owners, the bank and a house-moving contractor resulted in a procedure for acquiring right-of-way that is a new departure for the Indiana State Highway Department, and one that is very simple.

Briefly, the bank purchases the outstanding FHA-insured mortgages. The state purchases the land located on the right-of-way, exclusive of dwellings. It also pays each home owner an "inconvenience fee" for moving. The owner agrees to move his house within a specified time onto a new lot which he purchases, with money loaned by the bank when necessary. The contractor enters into a contract with the owner to move the house at a lump-sum price.

Money paid by the state for the land, plus the inconvenience fee is held in escrow by the bank which, following the completion of each move, pays the contractor his agreed price and issues a refunding mortgage to the owner, on the house in its new location. In general, this refunding mortgage equals the cost of purchasing the original FHA mortgage, plus the cost of the new lot and the contract cost of moving; minus the amount of state money held in escrow.

That this plan was well conceived is evidenced by the simplicity of its operation which, in large part, is based on cooperation of all parties concerned, with a clear understanding of each party's responsibility. Some two months were spent by state highway engineers and bank representatives studying the many complicated problems before the plan was put into operation.

The bank is protected because the

amount of each outstanding mortgage, which has been in effect for at least five years, is less than the amount of state funds held in escrow. For newly constructed homes, this would not necessarily apply. Refunding mortgages to be issued by the bank, and insured by the FHA, will be considerably less than the value of the homes in their new locations. Moreover, the bank will receive a fee of $150 to $300 per house for negotiating the purchase of the original mortgage and for other legal and technical services. The new site and the completed job of each house-moving are subject to the approval of the bank.

The state highway department benefits by dealing principally with the local bank instead of with the many finance companies holding the original mortgages. Moreover, its negotiations with the home owner and the moving contractor will be materially reduced—resulting in a speedier acquisition of the right-of-way.

Homeowner benefits most

But the home owner receives the most benefit. He will get an equitable price for his land (an average of $30 per running foot of frontage) plus an average of $250 for the inconvenience of moving. In addition, he will get the benefit of a new location of his own choice anywhere within a 15-block radius of the original site. And lastly, the restoration of service facilities at the new location, together with a new basement or foundation walls, sidewalks and driveways, must meet FHA construction requirements. About the only items he will not receive are a new lawn and landscaping. The cost of these are included in his inconvenience fee.

One of the significant innovations in this plan of purchasing right-of-way through a highly-developed residential area is that one contractor will move all the 102 houses. At the start of the program bids were received by the highway department from several house-moving companies, and the job awarded to the lowest bidder. Actually, he holds individual contracts with each of the 102 home owners.

The contractor is not required to furnish a cash bond but does not receive payment for moving a house until it has been installed on the new foundations and all items in the contract are fulfilled.

The contractor agrees to move the house and restore all facilities in kind. Where a new basement is required, it will be excavated to the same dimensions as the original one and walled with concrete blocks on a 4-in. thick concrete floor.

The heating plant will be moved and reset, a coal room will be built and a coal chute installed. All service facilities are to be connected.

If there is a garage, it will be installed on a new foundation, and new concrete sidewalks and driveways built to dimensions approximating those in the original location.

Relocation of the houses, which are timber frame, brick and brick veneer, and have a present-day value ranging from $7,500 to $30,000, got under way about May 15. Contract prices for moving the houses range from $3,630 for a 4-room frame house to $9,500 for a 1½-story brick veneer.

Contracts for moving these houses are held by the E. W. La Plante Co., Indianapolis, Ind., with George S. Hipp in charge of the work. Principal details of developing this unique plan of obtaining right-of-way were worked out by Walter Bruner, supervisor of right-of-way, Indiana State Highway Department, in collaboration with Charles N. Scott, vice-president, Calumet National Bank, Hammond, Ind. Nile Teverbaugh is assistant supervisor of right-of-way, and Ray Seely is project engineer.

Speedy acquisition of right-of-way for this first mile of Indiana's section of the Tri-State Highway will enable an early start on its construction, which is estimated to cost about $1,500,000 exclusive of right-of-way. Completion of this mile, together with the adjoining section in Illinois, will furnish a much-needed expressway from the southern part of Chicago to a connection with U. S. Highway 41 which traverses the western side of Indiana and extends to Miami, Fla. In addition, it will form one of the initial links in the Chicago Motor Club—Automobile Club of Michigan—sponsored Chicago-Detroit expressway.

Cities Plan Pay-As-You-Go Finance

Use of "pay-as-you-go" financing of capital improvements by cities is expected to virtually double this year according to reports cited by the International City Managers' Association.

A survey of cities over 10,000 population revealed that 243 cities financed capital improvements last year in whole or part with current revenues. City officials of 459 cities, marking a 90 percent increase, report they intend to finance at least some of this year's capital improvements on a pay-as-you-go basis.

Of a total 677 cities, 116 said they "plan to finance all capital projects from current revenues," while 343 cities said they intend to finance major improvements partly from bonds and partly from current revenues. The remaining 174 cities plan to finance from bond issues only.

Detroit headed the list of pay-as-you-go cities last year, investing $15.6 million of current revenues in capital improvements. Detroit is one of seven cities over 100,000 planning to finance all scheduled capital projects on a pay-as-you-go basis. The other cities are Cambridge, Canton, Grand Rapids, Hartford, Syracuse, and Washington, D. C.

Milwaukee, though still planning to finance most of its capital improvements from current revenues, expressed a willingness in a popular vote this month to issue bonds for necessary public works. Milwaukee has been on a straight pay-as-you-go basis for more than 20 years.

Washington spent $10.6 million from current revenues last year on capital improvements; Milwaukee spent $3.8 million; San Francisco, $2.9 million; Dallas, $2 million; San Diego, $1.7 million; Springfield, $1.6 million; Portland, $1.3 million; San Antonio, $1.1 million; and Wichita, $1 million.

Pay-as-you-go plans are generally preferable to financing projects through public borrowing. Many cities financing major works by bonds following World War I were forced to curtail services during depression years to keep up debt service and retirement charges. Interest on bonds often boost costs of these projects to taxpayers to nearly twice actual expenditures for construction.

Highway Drainage Research Expanded

The growing recognition by the highway engineer of the basic advantage of relying to the greatest extent possible on actual discharge experience in the design of waterway openings has led the U. S. Geological Survey to extend its program of aiding highway engineers in the solution of hydraulic problems. About 6,000 steam-gaging stations on important rivers and streams in all parts of the United States are now maintained by the survey. Records obtained at these stations are valuable for computing waterway requirements for bridges. However, the older stations are almost entirely on drainage areas in excess of 50 sq. mi. Few records were obtained for streams from the small drainage areas.

Efforts are now being made to correct this deficiency and, in a few years, records should be available from many small drainage areas representative of a wide variety of basin characteristics. In the new work the basic purpose is not primarily to determine what occurred in a particular flood in a given basin. Instead, the aim is to obtain data helpful in determining the expected frequency of floods in small drainage areas.

Typical of this expanded program is work now underway in Maryland.

Special Maryland work begun

Recognizing the need for additional hydraulic information on small basins, the Maryland State Roads Commission and the Geological Survey late in May formulated and placed in effect a comprehensive program of cooperation. The first part of the program is to consist of assembling and compiling flood discharge data already collected but not readily usable. For all gaging stations having sufficient length of record, the magnitude and frequency of floods will be computed and their relations studied.

The second part of the program consists of the collection of basic data from representative small drainage areas. The topography of Maryland may be divided into three general divisions—the mountainous area in the western part of the state, the rolling central area, and the flat coastal plain. In each of these topographic divisions there are to be installed index gaging stations on two streams, each equipped with a continuous recording gage. Crest-stage gages will also be added on about ten streams.

The typical crest-stage gage will consist of a length of 2-in. dia. pipe mounted vertically on a bridge abutment or in some other manner, and containing a removable graduated wooden stick held in a fixed position. These gages are designed to record the peak stage of each flood. At the bottom of the pipe one or more holes will be provided so that the elevation of the water in the pipe will be the same as that outside. A material such as powdered burnt cork will be placed on the surface of the water in the pipe to cause a stain to be left on the wooden stick at maximum highwater.

Several of the gages will be installed at each location to permit slope of the water surface, or the drop through a bridge or culvert, to be measured directly. Recording rain gages will be provided for some of the areas so that the rainfall-runoff relationship may also be studied.

Other states have programs

Similar cooperative programs of the U. S. Geological Survey are under way with the highway departments of Kentucky, Ohio, and South Carolina. The work in Kentucky was begun on a modest scale in 1938 and has been nearly tripled in size. Because of the lack of streamflow data on even the larger rivers in this state, the Kentucky project calls for installations of gaging stations on a number of large rivers as well as on small streams.

A rather comprehensive program was recently started in cooperation with the Ohio Department of Highways. This work is planned to cover the range of needs from small culverts to large bridges. Fourteen stream-gaging stations have been established over the state, being so located that at least one station is situated in each of the twelve highway divisions. These gages are on small drainage areas ranging in size from 0.3 to 10 sq. mi., and are divided as to landslopes with four of them on flat-sloped basins, seven on medium, and three on steep-sloped basins.

The new gages supplement four similar stream-gaging stations that have been in operation for some time on areas of from 1.6 to 14.8 sq. mi. In the vicinity of each of the old and new stations there has been installed a rain gage recording both the amount and the intensity of the rainfall. Over 100 crest-stage gages of the type previously described are also being installed on the small Ohio drainage areas.

Work in progress in South Carolina includes reports on the flow characteristics of specific streams at locations where bridges are to be constructed. This work aids in determining the adequacy of proposed structures for the maximum flood expected in a given period of time, for example, 25 years. Value of this work was recently revealed when studies showed that a long proposed bridge to span a slow-moving South Carolina stream could be shortened by 1,700 feet.

Machine-Finished Joints Used on London Railways

Machine finishing of joints and joint bars is being tried experimentally on new extensions of the railway lines of the London Passenger Transport Board as a means for further reducing batter at rail joints.

Except on curves where wear is excessive, it is the practice of the board to weld rails into 300-ft. lengths, which is about the greatest length that it is practicable to unload from a train standing between two signals, but there still is a large amount of wear at the joints between the 300-ft. lengths due to movement in the joints. Under the new plan, the rail ends and all contact surfaces between rails and fishplates are machine finished to produce a tight flush-fitting joint, and the bolt holes in rails and fishplates are drilled to a jig to insure accurate fitting.

To provide for expansion "expansion switches" are being installed at intervals of about half a mile. These expansion joints are formed by securing a point rail against the inner face of a slightly bent running rail in such a way as to allow a longitudinal movement of about 6 inches. The points are faced in the direction of traffic.

Waterworks and Sewerage Construction Hits Its Postwar Stride

Nation-wide activity indicates that we have started on a program involving more than $3 billion expenditure during the next decade

THE long-awaited revival of activity in the field of municipal water supply and sewerage construction is taking place. This is the conclusion to be drawn from a review of statistical evidence supplemented with on-the-spot field observations throughout the nation by the editors of this journal. Indications are that we are now on the threshold of an era of the greatest program of sanitation-projects construction that has ever been experienced in this country.

Looking first at the statistical side of the picture, these are the highlights: For the first half of this year, the volume of waterworks construction was $56 million, or 20 percent above the comparable period in 1946; sewerage construction volume was $64 million, or 40 percent greater than last year. Projected on an annual basis, it would appear that despite certain handicaps, this year's volume of sewerage work may reach the second highest level of previous accomplishment, and waterworks construction can be expected to fall within the bracket of fourth highest year on record.

These are auspicious signs pointing to the belief that we are solidly embarked on our post-war program of sanitation improvements. What this program amounts to in terms of long-term volume is revealed by the *Engineering News-Record* listing of proposed construction projects totaling more than one billion dollars for waterworks and over two billion dollars for sewerage. On the basis of past experience, satisfaction of this backlog will call for some ten years of concentrated effort.

Lending further substance to the reality of these statistics are the findings of the U. S. Public Health Service, an advance announcement of which is given on the pages following. In an inventory of sanitation needs the federal health service engineers reach these conclusions: Future water supply requirements total $2.2 billion and the overall cost of sewerage improvements will amount to $3.7 billion. That these needs represent more than a mere listing of desirable things to do is evidenced by the data, showing that some $740 million of water and sewerage work is ready for immediate construction, an additional $1.5 billion of projects are in the planning stage, and about $3.75 billion are under active discussion.

Any explanation of why the revival of activity has gotten under way would include these factors: (1) Shortages of materials have eased; (2) many demands for extensions and improvements (pressure for which existed even before the war and are now increased by service requirements for new housing) must be satisfied regardless of high construction costs; (3) wider acceptance of the philosophy that costs will not come down substantially, at least in an amount to justify further delay; and (4) the availability of money on such favorable terms as to compensate in part for higher construction costs.

SOME concrete evidence of the revival in construction of sewage and waterworks projects is provided by the articles in this special section. Here is a sampling of current developments in sanitation work from coast to coast that reveals the variety and scope of typical undertakings. It will be observed that a number of the projects described reveal changes portending significant departures from orthodox practice prior to the war.

Finally, it should be pointed out that this special issue has been timed to make its appearance on the occasion of the first combined meeting of the American Water Works Association and the Federation of Sewage Works Associations. It is of more than passing interest that these two groups should be jointly in conference on what is virtually the eve of a great national revival in water supply and sewerage construction.

BEGINNING A SPECIAL SECTION ON WATERWORKS AND SEWERAGE

Sanitation Needs — How Much and Where

Advance information from an inventory by the U. S. Public Health Service shows that water supply and waste disposal requirements call for $7.8 billion expenditure

CONSTRUCTION of water supply and waste disposal facilities for the United States will call for an expenditure of $7.8 billion, according to a national inventory of sanitation needs compiled by the Sanitary Engineering Division of the U. S. Public Health Service in cooperation with state health department engineers throughout the country.

Of this total, $6.2 billion must be spent to satisfy the needs of municipalities for water, sewerage, and refuse disposal services. The remaining $1.6 billion is required to provide safe water supplies and sanitary disposal facilities for individual homes which cannot be served by community systems. Detailed data showing the service needs and costs in each state as well as by size of community are shown in the accompanying tabulation. Publication of the complete inventory is expected to be made soon by the Public Health Service.

Work under way and planned

Other findings of the survey reveal that some $740,000,000 of water and sewerage work is ready for immediate construction, an additional $1.5 billion of projects are in the planning stage, and projects totalling $3.75 billion are in the discussion stage.

Two-thirds of the work ready for construction and half of that in the planning stage are in cities of more than 100,000. These cities included about 41 percent of the total population in all communities. On the other hand, in towns of less than 1,000, only about 10 percent of the needs will be met by projects now ready for construction or in the planning stage.

Per capita costs of needs vary from about $23 in Rhode Island to $107 in New York, and average about $60 for the nation as a whole. Costs tend to be higher in densely populated states and in states with high per capita incomes.

In towns of less than 1,000 population, satisfaction of needs is estimated to exceed $100 per capita while in cities of over 100,000 population, the per capita cost is about $80. In towns of intermediate size, the cost will be less than $50 per capita and in rural areas about $40.

Water supply undertakings

About one-third of the $2.2 billion requirements for water service extensions is in development of supply sources. This is said to reflect the high cost of completing New York City's Delaware supply; development of an upland supply to replace Philadelphia's present highly polluted supply sources; and additional developments to augment Denver's existing sources of supply.

About one-sixth of the waterworks budget will be applied to construction of treatment facilities and about one-half for distribution systems. These waterworks needs include 5,700 complete systems (most of them for towns of less than 1,000 population) and improvements of various kinds in 14,800 other communities. Some 3,200 new treatment plants are needed as well as additions to 4,700 existing plants. More than 45,000 miles of mains of various sizes are required to augment distribution facilities.

The survey reveals that Pennsylvania needs more water supply facilities than any other state. It will cost about $428 million to fulfill this need

On the other hand, Nevada with a population of 110,000 requires the least amount of water supply construction at a total cost of $1,868,000.

The overall cost of sewerage improvements is about $3.7 billion. One-third of this is for treatment works and the balance for collecting and intercepting sewers. Satisfaction of these needs calls for more than 80,000 miles of sewers, over 12,000 new treatment works and additions to some 1,000 existing plants. Complete sewer systems are needed by 9,100 communities, most of them small ones.

Expenditures for water and sewerage programs in some of the major cities include: New York City, over $1,000,000,000; Philadelphia, about $450,000,000; Chicago, $220,000,000; Detroit, $150,000,000; St. Louis, $85,000,000; Pittsburgh and Allegheny County, $80,000,000; Denver, $70,000,000.

For refuse disposal services some 12,000 trucks will be needed, the cost of which is estimated at almost $50 million. Construction of 1,090 incinerators will cost about $70 million. Another $25 million should be spent for equipment—such as, bulldozers and draglines—to operate 5,500 sanitary land fills. Land and miscellaneous expenses for refuse disposal will require an additional $20 million.

As in the case of water and sewerage works, more populous states and largest cities exhibit the greatest needs for improved refuse disposal service.

Reflecting the needs of the metropolitan district, New York State needs the most sewage disposal works. It will cost about $1.1 billion to construct these plants.

Again Nevada leads with the smallest amount of sewerage construction required. Its expenditure will come to only $2.2 million.

Rural requirements are large

Rural needs include repairs to existing water supplies or development of new supplies, mostly wells, for more than 6,000,000 homes where facilities are either wholly lacking or are insanitary. This will cost over $800 million. The same number of homes also need either new or im-

proved sanitary privies, the cost of which will total almost $400 million.

About 1,700,000 homes that have indoor plumbing but cannot be served by community sewer systems require either new or improved facilities for disposal of domestic sewage. These will cost about $400 million.

The maximum amount of rural sanitation is needed by Pennsylvania ($121 million), followed by Illinois whose needs total $106 million.

Basis for survey

A previous survey of sanitation needs was made by the U. S. Public Health Service in 1943, but this was based only on data on file in Washington. In the present inventory, trained sanitary engineers obtained first-hand information by making actual field surveys of individual communities. Estimates of costs made by municipal or consulting engineers were used with such adjustment as was necessary to reflect current costs. In communities that had no well-defined plans, field engineers made reconnaissance surveys to provide sufficient information for preparation of cost-estimates.

The fact that surveys were made during a period of steadily rising costs has complicated the work. An analysis of reports indicates that on the average they reflect costs of June, 1946, when the *Engineering News-Record* Construction Cost Index stood at 348 (based on 1913 costs as 100).

Since it was impracticable to survey every community in the United States, a sampling technique was used. Approximately 5,800 communities were surveyed of a total of 27,000 in the nation. Although communities of all sizes were included, emphasis was placed upon the more populous areas. Consequently, 78 million persons, constituting 75 percent of all who live in communities with population of over 200, reside in areas surveyed. Needs of unsurveyed communities were estimated, on the basis of conditions found in surveyed areas of similar size.

The inventory does not reflect any effort to provide a uniform type of service everywhere, it is stated. The survey takes into account the fact that local customs and practices, policies of state and local health agencies, and economic status of the community cause variations in needs.

ESTIMATED COST OF NEEDED WATER SUPPLY, SEWERAGE, REFUSE DISPOSAL, AND RURAL SANITATION FACILITIES BY STATES AND SIZE OF COMMUNITY
(Costs in Thousands of Dollars)

STATE	Population 1940 (1)	Water Supply	Sewage Disposal	Refuse Disposal	Rural Sanitation	Total
Alabama	2,833	16,482	31,171	1,171	81,492	130,316
Arizona	499	7,675	10,839	564	27,325	46,403
Arkansas	1,949	21,696	26,156	1,866	68,664	118,382
California	6,907	120,963	132,762	3,626	26,308	283,659
Colorado	1,123	85,179	10,447	703	10,535	106,864
Connecticut	1,709	20,120	39,194	3,797	7,644	70,755
Delaware	267	2,061	8,027	338	2,218	12,644
Dist. of Columbia	633	41,427	11,228	2,372		55,027
Florida	1,897	38,004	73,388	3,319	30,623	145,334
Georgia (2)	3,124	22,071	48,050	2,682	104,200	177,003
Idaho	525	8,993	11,928	442	5,879	27,242
Illinois	7,897	138,259	236,536	7,842	106,320	488,957
Indiana	3,428	43,458	91,309	3,838	33,129	171,734
Iowa	2,538	32,688	66,242	1,864	59,420	160,214
Kansas	1,801	21,221	49,981	2,273	22,429	95,904
Kentucky	2,846	22,051	40,410	1,965	42,933	107,359
Louisiana	2,364	32,712	37,656	2,866	54,283	127,517
Maine	847	6,313	19,988	415	19,598	46,314
Maryland	1,821	45,485	43,606	2,575	10,458	102,124
Massachusetts	4,317	54,080	70,258	5,750	5,818	135,915
Michigan	5,256	134,842	153,096	4,771	30,940	323,649
Minnesota	2,792	45,805	56,252	4,214	32,264	138,535
Mississippi	2,184	11,366	20,892	1,372	44,330	77,960
Missouri	3,785	52,132	120,132	4,885	43,183	220,332
Montana	559	8,596	8,765	323	8,807	26,491
Nebraska	1,316	19,252	29,011	1,830	22,866	72,989
Nevada	110	1,868	2,204	148	1,351	5,571
New Hampshire	492	6,344	10,165	120	5,948	22,577
New Jersey	4,160	33,084	149,396	8,208	22,347	213,035
New Mexico	532	5,490	11,147	416	8,429	25,482
New York	13,479	247,182	1,100,303	38,890	61,075	1,447,450
North Carolina	3,572	52,720	65,410	5,729	76,890	200,749
North Dakota	642	16,457	12,127	718	6,519	35,821
Ohio	6,908	118,264	137,006	10,876	30,461	296,607
Oklahoma	2,336	26,940	36,276	3,160	45,632	112,008
Oregon	1,090	18,067	29,950	699	10,560	59,276
Pennsylvania	9,900	427,983	340,949	9,394	121,931	900,257
Rhode Island	713	5,422	8,917	341	1,684	16,364
South Carolina	1,900	10,946	22,484	1,600	25,752	60,782
South Dakota	643	13,001	10,301	660	18,196	42,158
Tennessee	2,916	18,833	50,250	3,428	89,991	162,502
Texas	6,415	80,407	79,040	3,838	68,240	231,525
Utah	550	13,278	27,733	546	2,308	43,865
Vermont	359	2,023	4,297	250	4,550	11,120
Virginia (2)	2,678	34,460	51,324	2,809	47,894	136,487
Washington	1,736	35,418	45,616	2,315	18,262	101,611
West Virginia	1,902	15,591	63,508	1,427	22,503	103,029
Wisconsin	3,138	25,942	38,325	2,988	54,731	121,986
Wyoming	251	6,322	4,801	303	3,270	14,696
Total	131,669	2,268,982	3,748,853	166,526	1,650,220	7,834,581
Size of Community						
200– 500	4,109	235,918	263,972	6,842	.....	506,732
500– 1,000	3,582	125,804	218,463	8,589	.....	352,856
1,000– 5,000	13,181	255,889	558,682	33,631	.....	848,202
5,000– 10,000	7,386	113,579	219,665	15,043	.....	348,287
10,000– 25,000	10,156	153,057	237,494	18,731	.....	409,282
25,000– 50,000	7,377	109,232	161,102	12,908	.....	283,242
50,000–100,000	7,551	100,896	177,226	9,327	.....	287,449
Over–100,000	38,145	1,174,607	1,912,249	61,455	.....	3,148,311

(1) Populations obtained from 1940 Census. Community populations include both incorporated and unincorporated communities. Where more than one community was served by a single water or sewerage system they were considered as a single community.

(2) Figures for Georgia and Virginia estimated on basis of costs in adjacent States because of inadequate surveys. They are included in order to obtain national totals

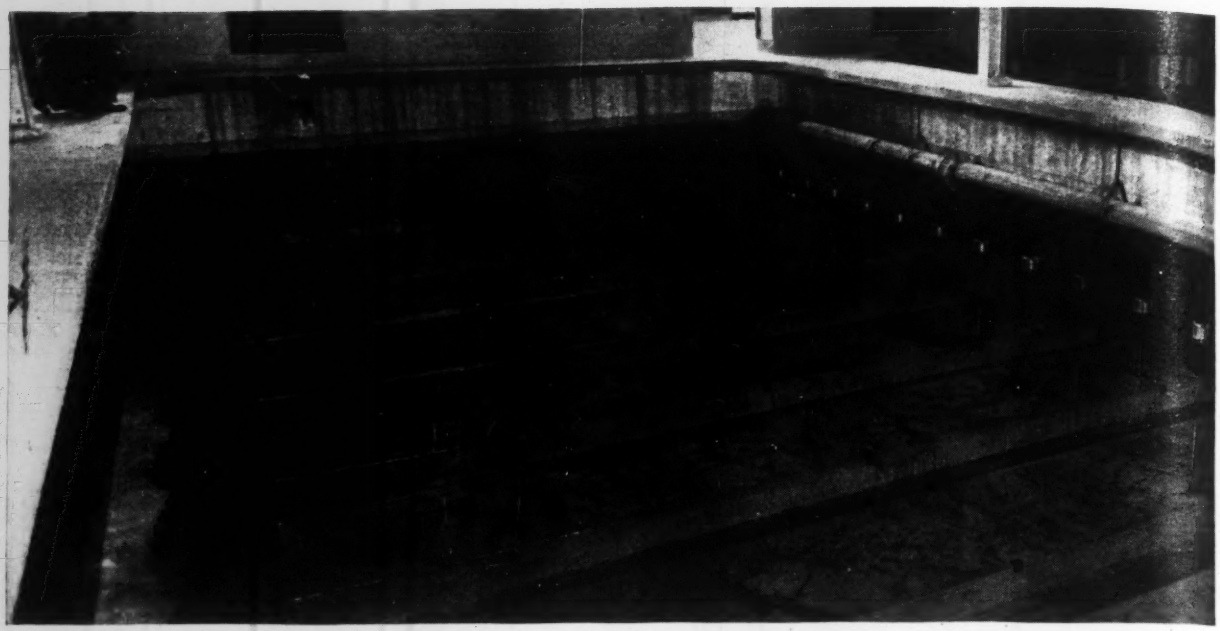


Fig. 1. Filters at Chicago's South District plant are backwashed with the aid of high-pressure surface agitators.

High-Rate Water Filtration Meeting Practical Tests at Chicago

***Contents in Brief**—Research that led to the adoption of special pre-treatment measures and a particular gradation of filter materials has made it possible for Chicago to process water at double the rate normally employed. Experimental work indicating that rates as high as 4 gpm. per sq.ft. were feasible is now being confirmed on a practical operating basis. Half of the completed filters are being operated at this rate. This article tells how laboratory findings were put into practice in the selection and production of filtering materials. Under rigid specifications 9,800 tons of graded gravel and 11,700 tons of selected filter sand were provided for Chicago's South District filtration plant.*

THE TIME-HONORED DICTUM of water filtration practice calling for "2 gallons per square foot per minute" may be modified as a result of preliminary runs at Chicago's South District treatment plant. In the operation of this newest (and world's largest) water purification plant, filters are performing successfully on a 4-gallon per minute per square foot rate.

Sixty of the 80 filters are now in operation. To meet consumption demands of 350 to 400 mgd for a few hours each day in the winter and spring months, and 450 to 500 mgd. in the summer, high rates of filtration are required. Thirty of the filters are set to operate at a 4 gal. constant rate, and the other thirty to operate at variable rates, with a maximum of 4.5 gal. for short periods. Behind this development lies an interesting story of filter research coupled with the exercise of unusual care in the specification and procurement of filter sand and gravel.

To determine treatment process best adapted to purification of Lake Michigan water, investigations were carried on by Chicago for more than thirteen years in a specially-built experimental plant. Selection of filtering materials and factors that govern water filtration received particular attention. This led to a series of studies on the size, shape, porosity, and type of materials depth of bed, grading of medium in bed, and of methods of washing filters.

To judge results of these experiments, two criteria were set up. First, turbidity of filter effluent was utilized as a measure of quality of water produced; it was established that coagulated matter be removed completely. Second, the clogging rate or time required for the loss of head to reach 8 ft. was used to evaluate roughly the economic feasibility of filtering material.

If filter runs are too short and excessive washing is required, the resultant loss in filter capacity becomes serious. In general, the medium that gave the longest runs and continue to remove turbidity completely was regarded as the most desirable.

Settled water was used in all tests.

In most cases aluminum sulfate was the coagulant.

Some tests were conducted in small plant filters, but most were made in glass tubes, 1.6 in. in dia. Results of earlier studies comparing large plant filters with small plant and glass-tube units approached agreement so closely that data obtained from experimental units could be considered reliable and accurate.

Use of small filters brought about important savings in equipment and provided easy and economical means for extending factors to extremes. For example, in studying effect of sand size, accurate screening of all material to the desired analysis involved a minimum of work and time. To have prepared material for large filters would have been difficult and expensive. Also, studies were speeded up. At one time 22 glass units were in service.

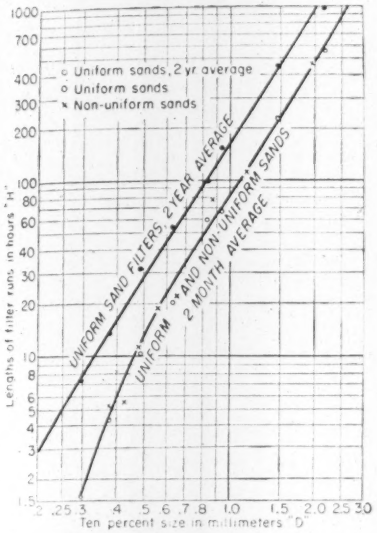

o Uniform sands, 2 yr average
o Uniform sands
× Non-uniform sands
UNIFORM SAND FILTERS, 2 YEAR AVERAGE
UNIFORM AND NON-UNIFORM SANDS 2 MONTH AVERAGE
Lengths of filter runs in hours "H"
Ten percent size in millimeters "D"

Fig. 1. At Chicago's experimental treatment plant the relation between sand size and the length of runs was determined from tests run on glass-tube filters, 1.6 in. in dia.

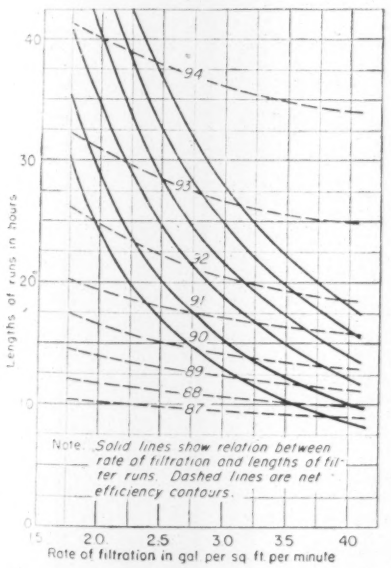


Fig. 2. The effect of rate of filtration on lengths of runs and efficiency of filtration are shown in this graph. These findings also are the result of extensive investigations conducted at Chicago's pilot plant.

Use of small filters brought about important savings in equipment and provided easy and economical means for extending factors to extremes. For example, in studying effect of sand size, accurate screening of all material to the desired analysis involved a minimum of work and time. To have prepared material for large filters would have been difficult and expensive. Also, studies were speeded up. At one time 22 glass units were in service.

Effective size by new method

Early in the work it was found that effective-size data obtained by the Hazen method could not be used satisfactorily to correlate effect of sand size on length of filter runs. The Hazen "effective size" is the "ten percent" size of material.

Experiments proved that a representative effective size of material cleaned by backwashing could be obtained by averaging a certain series of percent sizes. The percent size is the diameter of particle that has the stated percent of material finer in size by weight. Sizes as determined by screen tests used in the new method are the 1, 2, 4, 8, 16 and 32 percent sizes except that no size greater than 1.5 times the one-percent size was included.

For uniform natural sands, generally used in filtration plants, the new procedure gave effective sizes very close to those found by the Hazen method. When uniformity was lacking, results varied considerably.

In filter beds backwashed in the usual manner, sand in the topmost few inches of the beds does practically all of the filtering and almost all of the increase in loss-of-head over the initial losses takes place in this layer, regardless of the depth of bed. More fine sand will be found in the top six inches of a filter bed 36 in. deep than in the top 6 in. of a bed 12 in. deep. The rate of increase of loss-of-head consequently will be greater for the deeper bed.

The depth of the sand bed, therefore, affects the true size. To take this into account in estimating clogging rates, a filter bed with 24 in. of sand is assumed to be the standard bed. If the bed was to be shallower or of greater depth, the effective size was calculated by multiplying percentages of material by weight passing selected sieves by the actual depth of the bed and dividing this figure by 24. These results were plotted on a graph from which effective size was calculated by the new method.

The Hazen uniformity coefficient equals the 60 percent size (by weight) divided by the ten percent size. By the new method it is the percentage of material by weight that has a diameter less than 1.5 times the one percent size.

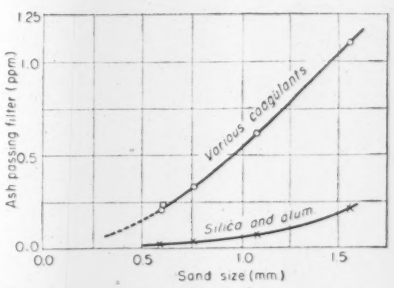


Fig. 3. When high filtration rates were studied at the experimental plant, coarse sand effectively removed turbidity only with the addition of sodium silicate to the coagulating chemical.

Sieves were calibrated

Standard methods of sieving and plotting results were used throughout the experiments, but percentages of fine sizes were determined more accurately. For sieving, with a shaking machine was found to be desirable. Sieves were calibrated by weighing the largest grains passing, as recommended by Hazen, except that the amount of material used was limited. For plotting results logarithmic probability paper was preferred. Sieve sizes and percentage of material passing the sieves were represented along the vertical and horizontal axes respectively. The sieve-size scale was subdivided into particle size in millimeters in order to facilitate computation.

From the resulting graph, the 1, 2, 4, 8, 16, 32 and 64 percent sizes, the percentage of material having a diameter greater than 1 mm., and the percentage having a diameter less than 1.5 times the one percent size were taken.

However, the 64 percent size was not used in computing the effective size, but was recorded for possible

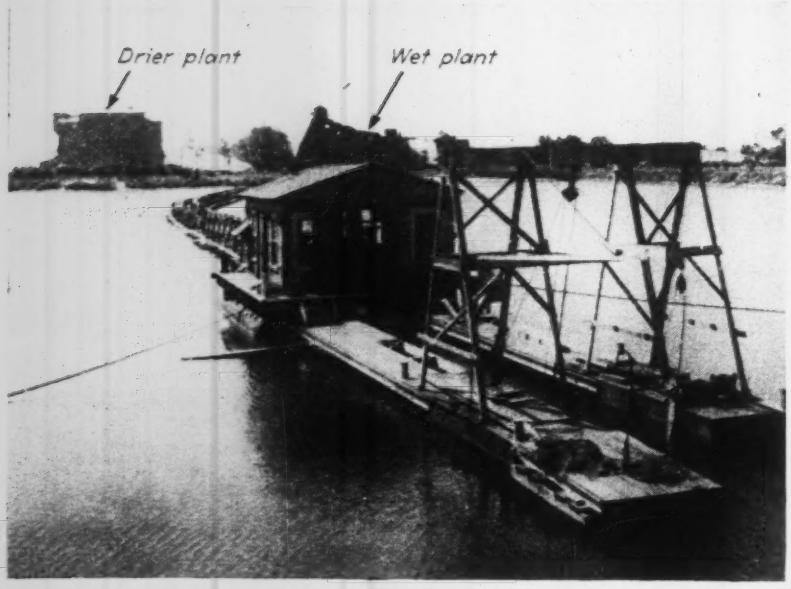


Fig. 4. At Muscatine, Iowa, sand and gravel mixtures were taken from the east lake by means of a hydraulic dredge and forced through a float-supported pipe line to the wet plant for initial screening.

use in specifications to obtain uniform grading.

Frequently, effective size of material that had been in service in filters for some time was desired. The loss of some sand in backwashing may cause the effective size to be different from the material originally placed in the filter. The procedure in this case was to press a tube of uniform diameter into the bed for a depth of 6-in. and remove the contained sand. After drying, the material was sieved and the results plotted as described. The effective size was calculated by averaging the 2, 4, 8, 16, 30, 60 and 90 sizes, except that no material larger than 1.5 times the diameter of the four percent size was included. This procedure yielded a result approximately equal to that determined from a representative sample of the whole bed.

Experiments were extensive

Experiments were divided into several series. First, sizes of filtering materials and depths of beds were studied. Next, the filtering effect of uniformly-graded materials was investigated. Sizes for filters covered a wide range—from material too fine to too coarse for use. Another set of tests was run to determine the effect of size and grading over a wide range. Simultaneous experiments were made on rates of filtration and depth of bed.

Filtering characteristics of materials other than natural sand were studied. Crushed quartz, anthracite coal, Minchar, coconut char, crushed glass, iron ore, iron oxide, and magnetite were tested. Experiments were run for periods long enough to collect reliable results.

Rate of filtration vs length of run

The effect of various rates of filtration on length of run was investigated. The first tests were conducted on small plant filters. Five filters were operated at 1.6, 2.0, 2.4, 2.8, and 3.2 gpm. per sq. ft. To cover a wider range of filtration, glass tube filters were operated at rates of 1, 2, 3, 4, 5, and 6 gpm. per sq. ft. These units were equipped to extend the loss of head through sand and gravel to nine ft., if necessary. Later, another set of tests utilizing small plant filters was run. Rates used were 2.0, 2.5, 3.0, and 4.0 gpm. per sq. ft.

In the first set of experiments to determine effect of size on rate of clogging, the effective size of sand varied from 0.307 to 0.568 mm. The uniformity coefficient ranged from 13 to 40. Then, filters were made up in which material for each unit was as uniform as possible. Material size varied greatly in each unit. Effective size ranged from 0.235 to 1.78 mm, and the uniformity coefficient was above 90 in every case. Porosities of sands tested varied from 4[illegible] to 37 percent. The length of run was the time required to reach an 8-ft. loss of head. The rate of filtration was maintained as closely as possible at 2 gal. per min. sq. ft.

Another series of experiments were performed to study material with effective size of 0.370 to 1.62 mm. and uniformity coefficient of 11.5 to 37. These materials (made up by mixing certain portions retained on various sieves) did not have grading characteristics of natural sands.

Porosity and shape of material studied

Experiments on various kinds of filtering mediums gave information upon affect of porosity and shape of material on filtration. Results were not consistent so that the exact influence of porosity could not be deduced. However, on the basis of available data, the duration of runs was found to vary roughly as the 2.5 power of the percentage porosity when sands are compared with crushed quartz. By use of surface wash this figure rose to 3.0.

By combining equations resulting from experiments on sand size, rate of filtration, and porosity, an expression for comparing performance of filtering materials was obtained:

$$H = C\,\frac{D^{2.15}\,P^{n}}{B^{1.5}}$$

where H = time to obtain eight-ft. loss of head in hr.
D = effective size in mm.
n = a constant whose value is between 2.5 and 3.5.
B = rate of filtration in gpm. per sq. ft.
C = a constant depending on clogging tendency of water.
P = the percentage porosity.

The value of C for any water can be obtained by testing a filter of known characteristics. Then, results for other materials can be estimated with the known value of C.

Higher filtration rates practical

One of the glass-tube filters containing 24 in. of sand (0.307 mm. effective size and 13 uniformity coefficient) removed all of the coagulated matter during the period of weakest flocculation. Another filter with 30 in. of sand (0.400 mm. effective size and 45 uniformity coefficient) produced similar results.

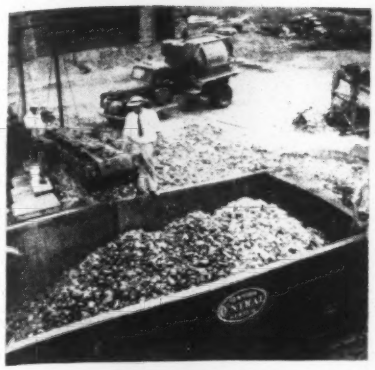


Fig. 6. Previous to shipment from Muscatine, Iowa, flat and elongated particles were removed from the 1½ to 3½-in. gravel as it was belt-conveyed to the railroad gondola. A water department inspector checked the material.

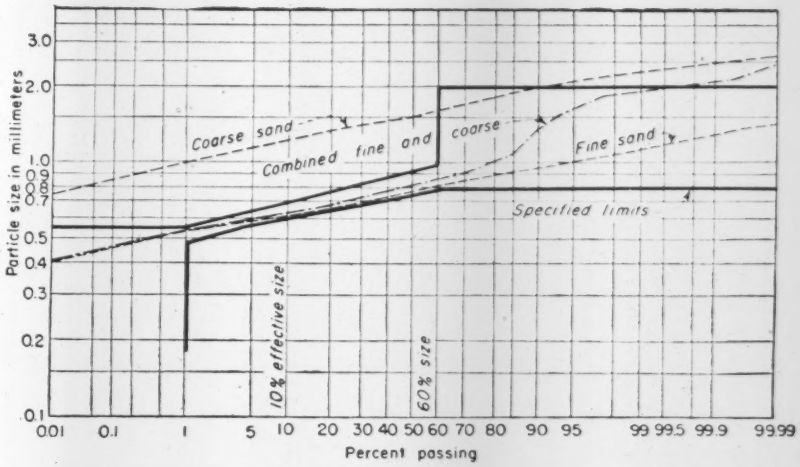


Fig. 7. Chicago's filter sand specifications and a typical size distribution of samples of sand obtained are represented on this graph.

However, these filters clogged so rapidly as to be impractical for plant use.

Additional experiments revealed that considerable time elapsed before coagulated matter would pass through filters having a sand with 0.500 mm. effective size. Except for periods of weak flocculation, all coagulated matter was captured by filters having a medium with an effective size of 0.600 mm. It was found that nearly all flocculated material lodged in the top layer of the bed even for coarse sand. But this material penetrated deeper into the bed with continued operation. Principal test of this process was the presence or absence of turbidity in the filtered water, the slightest amount being unsatisfactory.

Stronger coagulants needed

For the purpose of obtaining a clear filtered water under high rates of filtration, various means of toughening the coagulant were studied. Experiences with the application of acid-treated sodium silicate with aluminum and iron coagulants indicated that a much coarser filter sand could be employed successfully.

The relation betwen treated and untreated coagulated matter passing the filters and the effective size of sand is shown in Fig. 3. Less matter passed through filter sand of 1.25 mm. effective size using sodium silicate and a coagulant than through sand of 0.50 mm. effective size using only standard coagulant. This finding indicated that economy in first cost and in operation would probably be obtained by increasing the size of filtering medium and the rate of filtration.

Silicate treatment—the addition of acid-neutralized sodium silicate—toughened alum and ferrous sulfate coagulants to an extent that a rate of filtration considerably in excess of the customary rate could be used. An analysis of the hydraulics of the flow of water through the filtering medium indicated that economic considerations probably would limit this rate to about 4 gpm. per sq. ft. Clear water was not produced under this rate when only a coagulant was added. With silicate treatment excellent water was obtained even at rates in excess of 4 gpm. If sedimentation produced a water of 0.5 to 1.0 ppm. of turbidity, filter effluent produced at 4 gpm. per sq. ft. was of superior quality. No definite figure was established for the maximum rate but results demonstrated that silicate treatment would permit use of filtering rates at least 25 to 50 percent greater than normal.

The experimental work soon demonstrated that there was wide variation in the strength of the coagulation produced in treating the Lake Michigan water with aluminum sulfate, or one of the iron compounds—such .s ferrous or ferric sulfate. This caused wide variation in the clogging rate of filters handling water that had been coagulated and settled in the usual manner. At a filtration rate of 2 gal. the filter runs varied from 3 to 120 hr. giving a far wider range in the clogging rate than for most waters. Only by providing for special treatments in the design could a plant be constructed to handle at high filtration rates such wide variations in clogging tendency economically. Treatment to produce effective settling of floc during short filter runs had to be provided. Also use of coarse filtering materials requiring special treatment—such as, sodium silicate, to strengthen coagulation at times of low clogging, was required.

Specifications based on experiments

Investigational findings were incorporated into new specifications. First, sand size was defined so completely that undesirable material could not be furnished legitimately. Second, a more gradual transition in size from sand to gravel was demanded for the purpose of lessening jet action at the sand-gravel interface and preventing passage of sand into gravel layers.

These characteristics were attained by use of specifications that stated in part "The size of sand shall be determined by sieving through calibrated sieves. The calibration and sieving shall be carried out in the manner described in the *Water Works Practice* manual of the American Water Works Association, published in 1925. The diameters of sand grains will be computed as the diameters of spheres of equal volume. A chart shall be prepared in which the percentages of the material passing sieves of openings of various sizes are plotted against the diameter of the grains. When thus plotted the particle sizes shall be between the mini-

mum and maximum sizes given in the following table:

Per Cent of Material passive sieves (by Weight)	Diameter in Millimeters Desired Size	mum Mini- Size	mum Maxi- Size
1	0.520	0.485	0.550
2	0.550	0.520	0.590
4	0.600	0.560	0.630
8	0.640	0.600	0.680
10	0.660	0.620	0.700
16	0.700	0.650	0.745
32	0.780	0.720	0.840
60	0.900	0.820	0.980

Based upon the Hazen method of designating sand size, the effective size of the sand shall be between 0.620 and 0.700 mm. diameter, and the uniformity coefficient between 1.3 and 1.5. Compliance with the effective size and uniformity coefficient figures shall not relieve the contractor of responsibility to comply with the sizes given in the above table. The depth of sand in each bed was set at 24½ in.

It should be noted that the specifications used the Hazen effective size and uniformity coefficient. The main reason for inclusion of these definitions was that sand and gravel companies were not familiar with the new method, and that, consequently, bids might have been difficult to obtain under a new testing procedure. The specifications as used, however, were drawn up to give the most suitable size and grading of material in accordance with the new procedure.

Other sections covered source of sand, physical characteristics, solubility in acid, sampling and testing, transportation and placing.

Gravel sizes and layer thicknesses were delineated as follows:

Layer	Size Limits	Thickness of Layer
Bottom	1½ to 3½-in.	6-in.
Second	¾ to 1½-in.	4
Third	½ to ¾-in.	2
Fourth	¼ to ½-in.	3½
Fifth	⅛ to ¼-in.	3½
Sixth	⅛ to ⅛-in.	2½
Total thickness of gravel		21½

Processing a big operation

Procurement and processing of material for 30 filters, each having a surface area of 1,389 sq. ft., a 24½ in. depth of graded sand and a 21½ in. layer of selected gravel presented a problem of unusual magnitude.

After the decision had been made to use natural sand as the filtering medium, a search for a suitable source was made. Deposits of the Northern Gravel Co., at Muscatine, Iowa were found to meet grading and quantity requirements. In addition an organization skilled in processing of sands and adequate plant facilities were available. So a contract was let under which 9,300 tons of gravel and 11,700 tons of filter sand were produced.

Prior to the commencement of work two inspectors were trained in the testing section of the city's bureau of engineering. Methods of sieve calibration, sand analysis and chemical testing of aggregates were learned and efficient procedures for handling a large number of tests were worked out. These men were then sent to the plant where they remained for the entire shipping period of one year. There a total of 932 tests, all prior to shipment of 363 carloads of approved sand and gravel, were conducted.

The great pits at Muscatine contain very excellent materials for filter beds. When screened, all desired sizes, with one exception, were obtained without undue waste. Part of the gravel larger than the 1½-in. sizes was hauled from nearby gravel banks.

The processing plant located on a main railroad line is situated between east and north-west sand lakes—the source of raw material. Dredges were used to remove sand and gravel from the lake-pits. The east lake was utilized as the principal supply source. The natural mixture was taken from the pit bottom by a diesel-powered, hydraulic dredge and forced through an 8-in. float-supported pipeline to a receiving chamber at the "so-called" wet plant. A vertical bucket elevator then raised it to conical-shaped rotating screens. Heavy sprays of water were played on the finest screen to expedite the passage of sand and very fine gravel. This product then was pumped to the storage area in the rear of the sand-drier plant.

Gravel passing the rotating screens was dropped into hoppers and transferred to the "Niagara" screening unit for further classification.

Material taken from the west lake was screened on the dredge. Sand was pumped to the storage area, and gravel was conveyed to a storage pile on the east shore. Sizes under 1½-in. were hauled to the wet plant for rescreening. Larger gravel was hauled from nearby deposits and the plant to an elevated hopper near the wet plant when stones over 3½-in. were removed. The graded product was trucked to concrete storage platforms near the "Niagara" unit.

As the revolving screens did not produce specified sizes of gravel with sufficient accuracy, rescreening was necessary. This was done in the "Niagara" plant where one or more vibrating screens were used simultaneously. Gravel was hoisted from dump trucks to hopper by means of a one-yd. bucket crane. As screened material was belt-conveyed to railroad cars, a crew of men removed undesirable particles.

Screens changed to classify sand

Various classifications of gravel were produced in this plant by changing screens. Two screens generally were used at one time. One size was loaded directly into cars while the other was piled along the track to be loaded later.

From the vast storage pile sand was moved by means of a large, cable-operated scraper to a chute near the west end of the driver building. Then it was elevated by a conveyor into the hopper of a 30-ft. cylindrical drier heated with natural gas.

After being bucket-hoisted to the top floor, hot sand was sent over a group of mechanically-vibrated inclined, flat screens. Sizes ranging from ⅜-in. to ½ mm. were obtained from these screens. It is interesting to note that slightest changes in vibration influenced gradation and that only experienced operators were able to produce consistent results.

From the screens classified sand dropped into concrete bins holding about 45 tons, the contents of which filled about 60 percent of one, flat-bottom railroad car. Movable conveyors suspended from the ceiling were used to load cars. One car was loaded in about 35 min.

Two of the bins were reserved to handle the Chicago contract: one for coarse and the other for fine sand. A third bin was held for emergency loadings, or to receive material rejected under the specifications but suitable for other uses.

This work was performed under the Department of Public Works of which Oscar E. Hewitt is commissioner, W. W. DeBerard, city engineer, and John R. Baylis, engineer of water purification. C. Martin Riedel was in charge of making material tests at Muscatine.

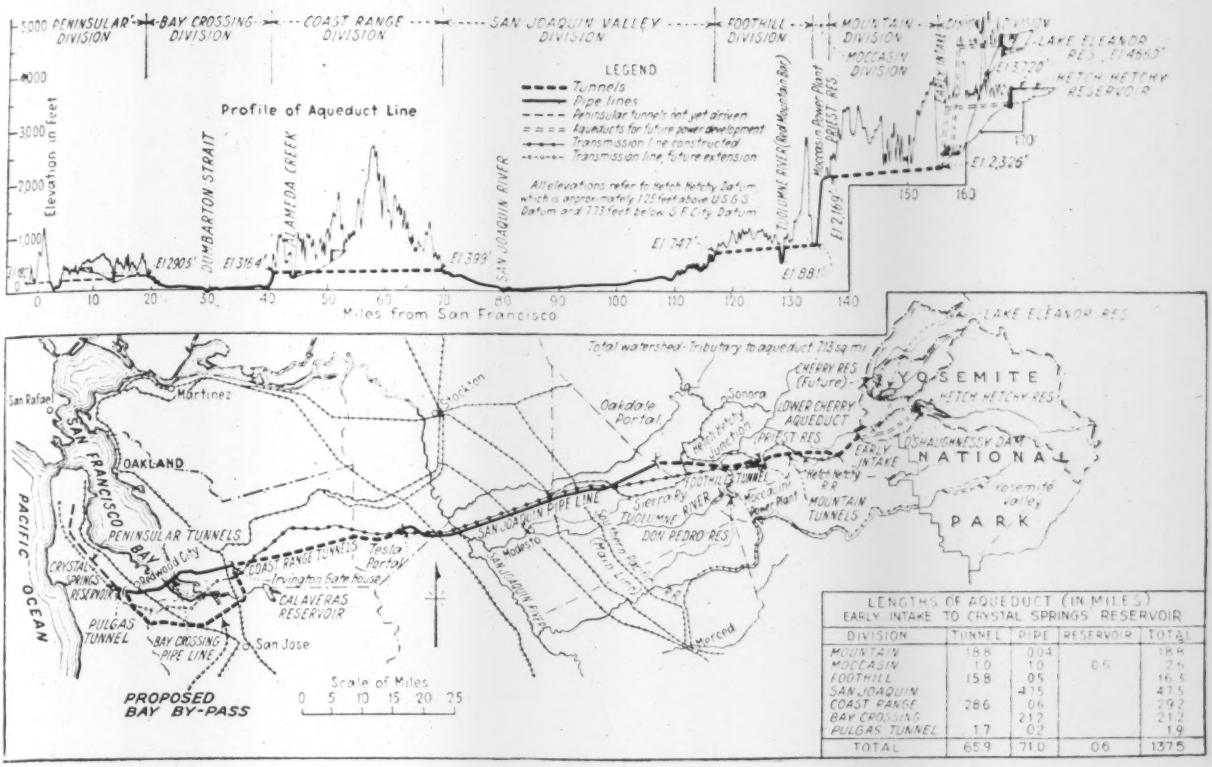


Fig. 1. Key map showing relationship of the proposed by-pass to the Hetch Hetchy water system that serves San Francisco.

New 72-In. Pipeline to Bypass Soft Bottom of San Francisco Bay

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General Manager and Chief Engineer,
San Francisco Water Department

***Contents in Brief**—San Francisco has expanded its water supply facilities at regular intervals in the past to satisfy the needs of a rapidly-growing population. To meet future requirements the capacity of the Hetch Hetchy aqueduct must be increased. This will be done by constructing another line (47 mi. of 62-in. pipe) across San Joaquin Valley, and by laying a 72-in. third Bay division pipeline that will carry 76 mgd. The new Bay pipeline will follow a dry-land route around the south end of San Francisco for three reasons: potential consumption in the area traversed, elimination of the danger of rupture to adjacent submerged lines during construction, and establishment of a factor of safety by not having all supply mains closely placed in one area. The two projects will cost about $25,000,000.*

FOR ABOUT 60 YEARS San Francisco has operated water supply pipelines across the southerly end of San Francisco Bay. At present a total of five pipelines ranging from 22 to 54 in. in diameter, all of which have to contend in some degree with soft bottom and deep mud, are in service. Now, for the first time since water has been brought to the San Francisco peninsula from the east side of the Bay, it is contemplated to provide additional capacity by laying a large transmission pipe around the south end of the Bay to avoid disadvantages of submarine crossing and to provide an added safety factor by separating these large mains. Some of the experiences and reasons leading to the decision to go around the Bay are outlined in the following. A summary of work done in developing the Hetch Hetchy source of water supply was presented in a series of articles published in a special issue of *Engineering News-Record*, Aug. 2, 1934, p. 134.

The first water pipes to cross the Bay were twin 16-in. lines laid in

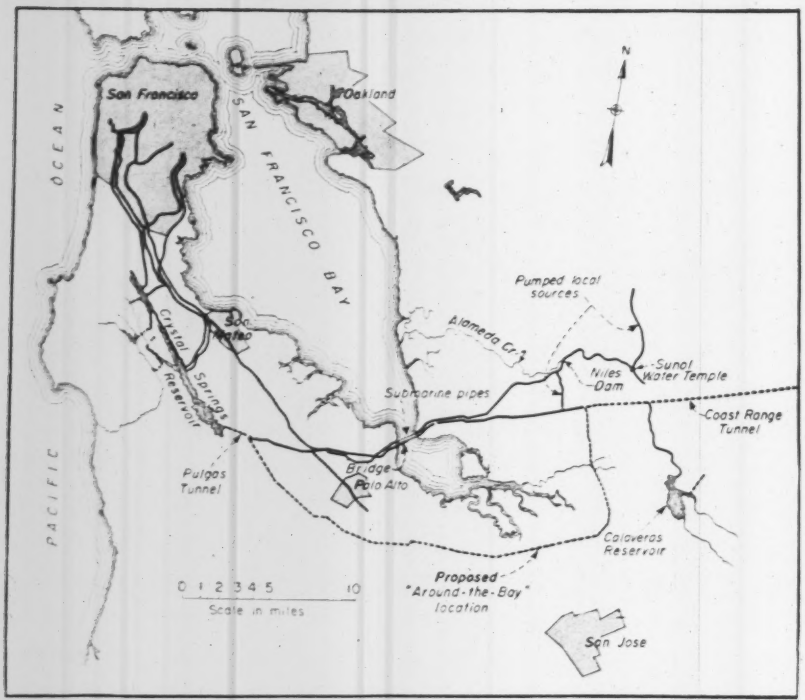


Fig. 2. The Bay crossing division and approximate location proposed for new 72-in. line around south end of San Francisco Bay.

1933. They antedated completion of the Hetch Hetchy project by nearly 40 years because Herman Schussler, far-sighted chief engineer of the Spring Valley Water Co., recognized the need for a much larger water supply than could be drawn from the limited catchment area on San Francisco peninsula. He bought water rights and reservoir sites, constructed filter galleries, diversion dams and well fields in the drainage basin of Alameda Creek, and brought the water developed there across the southern end of San Francisco Bay in submarine pipelines.

First pipes across the Bay

Properties acquired in the East Bay area under the guidance of Herman Schussler for water supply purposes were ready to produce about 1888. By that time he had begun construction on a pipeline from Niles Dam to the San Francisco peninsula, crossing the Bay in a pair of 16-in. pipes, the first of the series of submarine lines.

These first pipes were made of $\frac{5}{16}$-in. wrought iron, galvanized, and with cast iron ball-and-socket joints riveted to the wrought iron tubes. Each pipe was coated by dipping in a combination of asphalt and coal-tar. How well this protection served is shown by the fact that, when a portion of the lines were taken out in 1936 (some 48 years after installation), the metal was found to be in such good condition that pipes were reused. That is, ball ends were cut off, sections were sandblasted, pits were welded up, and pipes were relaid in the distribution system.

The original pair of lines across the Bay was laid from a floating cradle. Joints were leaded and caulked as each successive length was added to the line and, as the barge moved forward, the pipeline was eased down on to the Bay bottom. These lines were laid in bottom mud without advance preparation of trench or trestle. Moreover, the route followed deviated materially from a straight line as storm and tide exerted their effect on the barge that was held in place only by means of anchors and cables.

So satisfactory was the first pair that in 1901, when more capacity was needed, an additional pair of 22-in. lines was put down paralleling the first pair and using similar construction methods. The second pair, which gave equally satisfactory service, were of Bessemer steel plate $\frac{3}{8}$ in. thick.

In the initial construction project carried out to bring Hetch Hetchy water to the San Francisco peninsula, some portions of the aqueduct were built with only enough capacity to supply the city's needs for the next 25 years. The 18-mi. section of mountain division tunnels, for reasons of construction economy, was built to provide an ultimate capacity of 400 mgd. In the 29 miles of Coast Range tunnels it was economical to build initially for about half of this capacity, leaving enlargement to ultimate requirements for a second parallel bore. But in the pipeline across San Joaquin Valley and from the west end of the Coast Range tunnel, the first installation was equivalent in capacity to a single 60-in. pipeline. In some sections the line was larger or smaller, according to gradient. As a whole, the objective in that first step was to provide a capacity of not less than 60 mgd.

The San Joaquin Valley line was laid with a nominal diameter of 60 in. That is, with a 35-lb. pressure at the upper end (Oakdale portal), it was designed to deliver 73.5 mgd. when new (60 mgd. ultimately). The actual diameter varied from 56 to 66 in. and thicknesses from $\frac{5}{16}$ to $\frac{1}{2}$ in. The smaller diameter was used under higher pressure to reduce required plate thickness. The valley pipeline, which has a length of some 47 miles, terminates at the east end of the Coast Range tunnel.

First pipe laid in submarine trench

From the west or Irvington portal of the Coast Range tunnel to the shore of San Francisco Bay, the nominal diameter of this first step in bringing in Hetch Hetchy water was kept down to satisfy immediate needs of 45 mgd. The Bay crossing itself, as originally designed, contemplated ultimate installation of four 42-in. cast iron pipes with ball-and-socket joints. The first of these was laid in 1925 in submarine open trench excavated to firm clay, on the bottom of which had been deposited a layer of crushed rock (*ENR*, March 18, 1926, p. 434).

Newark Slough, which is on the east side of the Bay about 1½ mi. from the shore, is crossed by a 405-ft. length of the 42-in. pipe. In the deeper part of the Bay proper there is 2,700 ft. of the 42-in. ball-and-socket pipe. On the peninsula side of the deep

channel, a steel bridge some 3,000 ft. long was built to connect the submarine part of the crossing with the west shore. This bridge was designed to carry two 76-in. pipes but initially only one 66-in. line was built.

Newark Slough troubles

That portion of the line in Newark Slough has given a great deal of trouble as the bottom is of soft mud and, although laid on a thick bed of crushed rock, the pipe has a tendency to move sideways out of line. Three breaks in this line have resulted from lateral thrust. Internal pressure increased the tendency to further movement once the initial deflection took place. Being submerged, movement was not apparent until a joint had opened and revealed the condition. The first trouble which occurred shortly after the line was put in service was repaired by excavating beside the pipe, straightening alignment and backfilling with a substantial body of crushed rock on both sides.

After the second break, which occurred in 1935, the pipe was straightened as much as possible, although some of the joints could not be pulled quite back into line and joints were recaulked where necessary. This time, in an attempt to hold alignment, piles were driven alongside each ball joint. These were capped just above the pipe and steel straps were passed under the pipe to fasten it to the timber structure so that the line was suspended from a pile trestle. This held until 1938 when the line broke again. The line was again straightened as much as possible, joints recaulked, and batter piles were driven opposite points of deflection to strengthen bents against horizontal thrust. Then rock backfill was replaced alongside the line.

These repairs held until 1943 when the pipe slid sideways enough to open several joints. In a determined effort to stop the trouble the city again partially straightened the line and installed a 36-in. welded steel line of $\frac{7}{16}$-in. plate inside the 42-in. pipe. The annular space between the two pipelines was filled with a grout mixture pumped in under pressure. By this expedient sufficient rigidity was imparted to the line so that in the past three years no further movement has occurred.

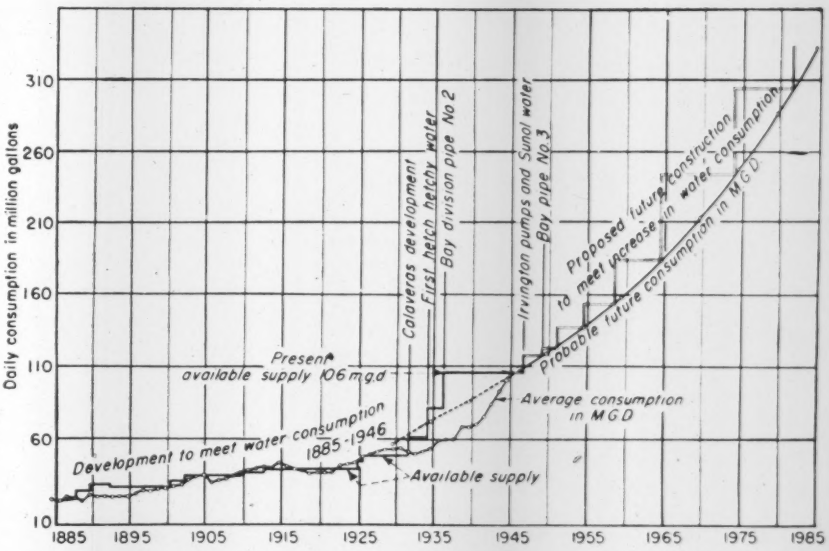


Fig. 3. Chart of water system capacity and consumption; actual, to date and estimated to the year 1985.

One other movement in the section of the 42-in. line crossing the Bay worthy of note was a slight pulling of one of the joints in the tidal zone on the east shore of the Bay. Here, where there was opportunity to inspect the line, it was observed that a joint had been pulled out about a half inch, enough to cause slight leakage. The lead was recaulked and no further evidence of movement has been found. In view of lateral movement in Newark Slough certain apprehension was felt during the time that the 54-in. line was being laid lest dredging for its trench might cause movement of the nearby 42-in. ball-and-socket type lines. When backfilling was placed, this menace was removed. This experience was a factor in the desire to avoid any future disturbance of existing submarine lines.

Plans for a detour line

In 1934 when it again became necessary to provide additional capacity across the Bay for Hetch Hetchy water, a study was made to determine whether some improved type of submarine construction were available. Larger diameter pipes were desirable and this meant there would be need for ample assurance of safety. Consideration was given to use of wrought iron and to corrosive resistant alloys. Samples cut between high and low tides from the 16-in. wrought iron and 22-in. steel lines laid in 1888 and 1902, respectively, showed both of these lines to be in excellent condition, indicating that a steel line properly protected and installed would offer an extremely long life.

Use of bolted flange joints practical

Careful study and discussions with contractors who had had extensive experience with marine and underwater work indicated that it was entirely feasible to lay 54-in. steel pipe with bolted flanges on submarine pile trestle with caps at predetermined elevations, forming a smooth profile. On the basis of further studies, this latter type of construction appeared to offer several definite advantages over the ball-and-socket type, particularly in such large diameter as 54 in., including the item of cost.

Bids were received on both types of construction, namely: (1) cast iron with ball-and-socket joints and (2) concrete jacketed steel with heavy balled flanged joints, this pipe being made of a $\frac{3}{4}$-in. plate and a 6-in. concrete jacket and laid on submarine pipe trestle. Bids were $928,500 for cast iron and $698,200 for concrete-jacketed steel line. Both contemplated two lines across the Bay and a single line across Newark Slough.

The contract was awarded on the basis of a pair of 54-in. steel pipes placed on a submarine wooden trestle constructed by divers on the Bay bottom. This line, described in *Engineering News-Record*, June 4, 1936, p. 797, has given satisfactory service

and is believed to have remained exactly in place on the trestle as laid.

The new lines were laid as far as possible from the original 42-in. line to avoid disturbance. However, it was necessary to cut in fairly close at the eastern end to join up with the connecting line.

A 72-in. pipe needed

The time has now arrived when the capacity of the Hetch Hetchy aqueduct must be increased. This will involve two major items. One is construction of a second line across the San Joaquin Valley involving some 47 miles of 62-in. steel pipe. The other is a third Bay division pipe (76 mgd.) extending from the Irvington or west portal of the Coast Range tunnel to the Pulgas tunnel which discharges into Crystal Springs reservoir on the San Francisco peninsula. Both of these lines are to be of the same capacity, namely, 76 mgd. In the Joaquin division the second line is to parallel the original line, in the same right-of-way and presents no new problems.

In planning the new Bay division pipe, however, the city's engineers have decided to lay the line on dry land, following a route around the south end of the Bay, keeping generally to the foothill slopes and above high tide.

This location will make the pipeline somewhat longer, about 34 instead of 20 miles, and will involve acquiring new right-of-way through the entire distance. It also calls for increased diameter (72 in. equivalent) because of flatter hydraulic gradient. The proposed route traverses certain districts where additional potential consumption exists, but the determining factors in adopting the "Around-the-Bay" route was the additional factor of safety in not having "all the eggs in one basket."

Additional submarine line hazardous

Laying an additional submarine line would involve several disadvantages, namely, (1) hazard to existing lines during construction, (2) danger that a break in one line might result in damage to adjacent lines, and (3) repair to a submarine line is slow and costly. A surface line can be repaired readily and service restored in short time.

The cost of these two additions to the water supply system, estimated at $25,000,000 in accord with the original plan for financing the Hetch Hetchy project, is to be provided by revenue from sale of bonds. A bond issue in this amount is expected to be put before San Francisco voters at an early date.

Need for increased water supply

San Francisco's program for bringing a water supply from the High Sierra by developing the Hetch Hetchy project was laid out on a planned ultimate capacity of 400 mgd. With the available local supply, this was expected to meet any future requirements. For San Francisco and the South Bay area early work on the Hetch Hetchy development, on which construction began in 1914, included completion of the 18 miles of tunnels in the mountain division and 16 miles in the foothill division. Across the San Joaquin Valley and in the Bay crossing division, where pipelines were to be installed, it was planned to provide needed capacity on a progressive unit-construction program. Thus interest was saved on investment in capacity not needed at the outset. The capacity increase now being planned is expected to provide for the city's needs to 1965.

Demand for water in San Francisco increased rapidly during the four war years, as shown in the accompanying chart. Capacity of the supply system was not increased during those years. In that time the average demand increased from less than 70 mgd. to more than 100 mgd. Thus the present plan to add the 72-in. line is a move long delayed by inability to make extensions to the system during the war.

Following the work proposed to be done immediately in the San Joaquin and Bay division pipes, four more steps will carry the Hetch Hetchy project to completion. These steps are based on a normal uniform growth of about 3 percent per year. Work proposed and dates when it is expected to be needed are as follows:

1965, Bay division pipe four and San Joaquin pipe three.

1947, Bay division pipe five and San Joaquin pipe four.

1976, Second Coast Range tunnel.

1982, Bay division pipe six and San Joaquin pipe five.

To Meet Growing Industrial Demands Cleveland Expands Water System

Plans and specifications for a new intake structure—first step in a $35,000,000 water supply improvement program for Cleveland, Ohio—are now completed and ready for bidders.

Scheduled for completion in 1951, the overall program will include installation of flocculating equipment, dry-feed machines, activated carbon handling facilities and filter beds at existing plants; relining of some 30 mi. of mains and the addition of more than 40 mi. of new feeder mains, and construction of the new intake and a filtration plant at Nottingham.

William L. Havens, consulting engineer for the city, said the new intake will have a nominal capacity of 150 mgd., and will include 1½ mi. of tunnel from screen well to shore shaft, and a 10-ft. dia. pipe, extending from the shore shaft to a submerged crib located approximately 3½ mi. offshore.

Contracts have recently been awarded for several new feeder mains, and for the construction of a new 25 mg. filtered water reservoir at the Nottingham site.

Pending the completion of the new plant, this reservoir will be filled from existing mains during hours of low consumption, and will be utilized as storage for booster pumping during peak day demand. Now in progress is the design of additional mains and storage facilities, as well as that of the Nottingham filter plant which will have an initial "rated" capacity of 100 mgd.

All of these improvements were recommended in a March 1946 report upon "Water Supply Needs for Metropolitan Cleveland" by Havens and Emerson, consulting engineers, who are also designing and supervising construction of the work under the general direction of Thomas A. Burke, Mayor, Emil J. Crown, director of public utilities, and George W. Hamlin, acting commissioner of water and heat.

Imbedded Coils Heat Sludge Digesters

L. L. Sphar
Parker and Hill, Civil and Consulting Engineers
Seattle, Wash.

***Contents in Brief**—Design of a sewage treatment plant for the city of Puyallup, Wash., calls for sludge heating by means of coils imbedded in the concrete walls of the digesters. Although the construction features are similar to radiant heating systems, it is expected that the heat distribution will be accomplished by convection currents. Attention was given in the design to control of pH in the digesters and control of plant odors.*

HEATING OF SLUDGE by means of coils imbedded in the walls of digesters has been incorporated in the design of a sewage treatment plant for Puyallup, Wash., to provide better operating characteristics and lower maintenance costs. Construction features are similar to radiant systems for space heating; but, in the case of sludge heating, it is expected that heat distribution will be accomplished by means of convection currents and conduction rather than by radiation.

Puyallup is located some 10 miles southeast of Tacoma, Wash., on the Puyallup River and had a 1945 population of some 11,000. The process to be used in the new plant will be primary sedimentation and separate sludge digestion with effluent discharging into the river. The plant is designed for an average flow of 4.3 mgd. from a design population of 15,000 plus flow from five canneries. An allowance was also made for a peak flow of one week duration each year during a fair that draws a large crowd to the city.

The design takes advantage of existing topography by locating the clarifier and sludge drying beds on a flood plain near the river and the control house and digesters on a nearby slope. These latter structures are dug into the hillside so that backfill will serve as insulation.

At the present time Puyallup is almost entirely unsewered. Each property owner provides such disposal facilities as he can afford and maintain. Because this system is expensive individually and undesirable from a health standpoint, a city-wide sewer system is contemplated. In connection with this project, the Washington state department of health has ruled that raw sewage must be subjected to at least primary treatment and chlorination before it is discharged into the river.

Bids received in 1946 for the construction of the plant were rejected as too high. It is hoped that bids can be called for again this year and the project completed by the summer of 1948.

Lower maintenance costs expected

One of the primary reasons for imbedding heating coils in the concrete walls of digesters is to reduce maintenance costs. Exposed heating coils in the relatively inaccessible lower portions of sludge digesters frequently are subject to sludge caking and require much maintenance to maintain efficiency. In the Puyallup plant, although water can be circulated through the tubes at a much higher temperature than where exposed tubes are used, the surface temperature of the concrete on the inside of the digesters will be maintained at less than 140 deg. F. This is expected to minimize sludge caking.

Coils provide uniform surface heating

The imbedding and spacing of the coils near the bottom of the digester walls were so designed that a fairly uniform heat on the surface of the wall will result in the coil area. It is expected that this will distribute heat through the sludge efficiently. However, it has not been determined what proportion, if any, of the heat will be conveyed by radiation. Indications are that the greater portion of heat transfer will be by conduction and convection. Consequently, coil design was based on these factors alone. Radiation would probably effect a better penetration of the sludge and result in a more uniform heat distribution. Further, radiant energy may

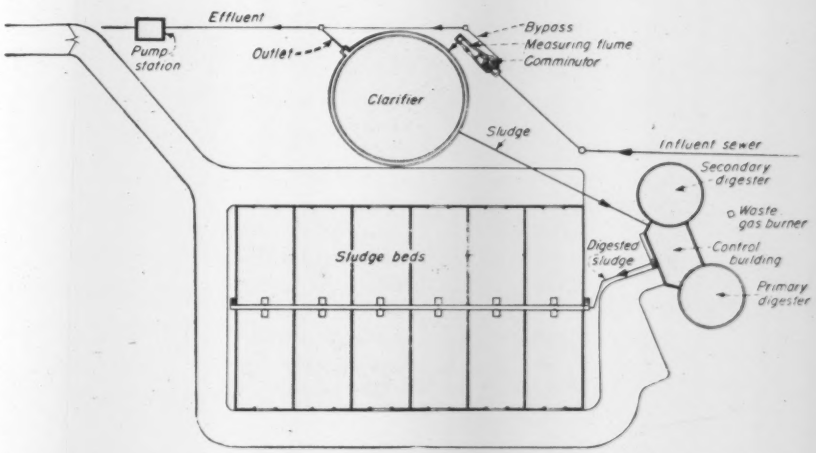


Fig. 1. Advantage of topography was taken in the layout of Puyallup, Wash., sewage treatment plant by placing the digesters and control house in a hillside location. Thus the earth backfill is conveniently used to minimize heat loss.

DESIGN AND ENGINEERING DATA PUYALLUP, WASH., SEWAGE DISPOSAL PLANT

Treatment: Comminution, primary sedimentation, two-stage sludge digestion, air-drying of sludge, and gas recovery for heating purposes.

Plant Capacity: 4.3 mgd. aver.; 6.5 mgd. max., based on a design population of 15,000 plus flow from five canneries and summer fair.

Sewage Characteristics: Domestic and industrial wastes with per capita daily average of 6,300 lb. suspended solids and BOD. of 6,500 lb. Acid effect of cannery wastes expected to be of consequence but quantitatively unpredictable.

Pre-treatment: 40-mesh screening and liming at the canneries to reduce solids load and maintain alkalinity in sewers.

Comminutors: Revolving drum type. Hand-cleaned bar screen comminutor by-pass.

Clarifier: One circular tank, 85 ft. dia. and 8 ft. 6 in. deep at the outside wall. Equipped with rim-drive sludge collection and scum removal mechanism. Retention 2 hr. at aver. flow. Max. overflow rate 900 gal. per sq. ft. per day.

Chlorination: Automatic raw sewage chlorination regulated by flow through Parshall flume. Capacity 150 percent max. design flow. Estimated chlorine requirement 10 ppm. for aver. conditions in summer.

Outfall: 24-in. concrete pipe to river bank. Automatic pump station operates during high river stages.

Sludge Digesters: Two tanks, 40 ft. dia. and 21 ft. deep with floating covers. Reversible two-stage operation. Capacity based on 75 percent solids removed plus allowance for peak cannery loads.

Digester p-H Control: Milk - of - lime (1 lb. lime per gal. water) added to new sludge as required. Solution mixed and stored in 150 gal. batches.

Digester Gas Collection: Equipment designed to handle from 6,000 to 15,000 cu. ft. per day. Gas used to fire 500,000 B.t.u. boiler for digester and building heating. Excess gas wasted. Make-up gas automatically supplied from domestic main.

Digester Heating: Hot water circulated in imbedded copper tubes. Primary tank temperature automatically maintained at 85 deg. F.

Sludge Drying: 12 open-air beds, each 36 x 68 ft.

Dry Sludge Disposal: Used as fertilizer. Hand loading to farmers' trucks.

Cost: Low bid submitted in 1946 and rejected was $256,000.

have the same stimulating effect on biologic activity in the sludge that has been observed in the effect of sunlight on biologic growth in streams and ponds. Thus, a shorter digestion period may result or a more thoroughly digested sludge may be produced. Operating experience may indicate that future installations can be reduced in size.

The heating system was designed for a sludge temperature of 85 deg. F. and the concrete surface temperature was restricted to 140 deg. F. to inhibit sludge-caking. Calculations made by designers and checked by the Washington state department of health indicate that use of six tubes toward the bottom of the wall provides ample heating capacity.

Originally eight tubes were specified. However, the addition of external rock-cork and felt insulation to the digesters, it is believed, will conserve enough heat to warrant the reduction in a number of tubes.

The "radiant" method of heating sludge (i.e. imbedded tubes) has been criticized because "the added resistance of the concrete would inhibit the flow of heat." However, it has been pointed out that the imbedded tubes will produce a temperature at the surface of concrete as high as would be permitted in exposed pipes and more contact area will be provided. Besides this, it is claimed to be simpler and more economical to heat water to the higher temperature required in the imbedded coils than to maintain the water at the lower temperatures required in exposed coils.

In the new plant, two-stage sludge digestion will be employed. Each digester is 40 ft. in dia. and 21 ft. deep at the side wall. The digesters will be reversible; that is, either may be used for primary or secondary digestion. The primary digester, however, will, be the only one heated. Earth backfill will extend to within 5 ft. of the top of the wall and the tanks will have floating covers. In this location the water table is high and uplift pressure governs in design. Accordingly, bottoms of digesters were designed as inverted domes for strength and minimum concrete.

Thermostatic temperature control

The temperature of sludge in the primary digester will be maintained at 85 deg. F. by a bulb-type thermostatic control suspended in the middle of the tank. This control activates pumps which circulate hot water through the imbedded coils.

The temperature of water as it leaves the boiler will be adjusted on the basis of operating experience. Facilities are provided for measuring temperature of the inside wall face by means of an immersion thermometer. The water temperature will be adjusted in accord with the wall temperature so that the latter will not exceed 140 deg. F.

Industrial wastes have pretreatment

Capacity is provided in the design to accommodate wastes from local industrial installations. Most important among these are five canneries which discharge enough waste in the summer season to require doubling of sludge digestion and drying capacity. If these wastes are not neutralized before entering the sewers, they will turn acid by fermenting. Accordingly, a special ordinance was passed to require canneries and other industrial plants to provide a certain degree of pretreatment of wastes so as not to unduly burden the plant with acid wastes carrying a relatively large amount of solids.

It is understood that this is the first such ordinance to be passed in the state of Washington. It is felt that its provisions are stringent enough to protect the sewage treatment plant and, yet, liberal enough so that an undue burden of treatment needs is not placed on individual canneries. The ordinance provides that, where necessary in the opinion of the city engineer, all industrial wastes shall be passed through a 40-mesh mechanical screening device, shall be dosed with lime to maintain alkalinity,

and shall be treated so that maximum five-day BOD. is less than 3,000 ppm.

Attention given to odor control

Special attention was given to the matter of odor control and the design includes the following provisions to minimize odors: (1) Chlorination of the sewage as it reaches the plant to prevent putrefaction in the clarifier, (2) constant removal of scum from the clarifier after which scum is kept enclosed, and (3) provision for planting of trees and shrubs to take best advantage of prevailing winds to disperse such ordors as occur.

The scum flows continuously to a sludge pit located in the control house and is kept under cover after leaving the clarifier. Sludge also is collected in this pit and the lime mixture for pH control is added here. The sludge pit provides a low point to which digesters can be drained by gravity.

Mechanical mixing of milk-of-lime solution to be used for pH control is considered a special feature of this plant. Because of the uncertain character of the cannery wastes, ample facilities for storage and addition of this alkalizer to the sludge is provided. The quantities used will be based on operating experience and frequent hydrogen-ion determinations.

The solution is mixed and stored in a 3x4x3 ft. concrete tank. New batches of milk of lime can be made in this tank as needed.

A flash type mixer is provided for the initial mixing and for stirring the solution before each application.

The plant was designed by Parker & Hill, civil and consulting engineers, Seattle, Wash. The city engineer of Puyallup is W. E. Berry.

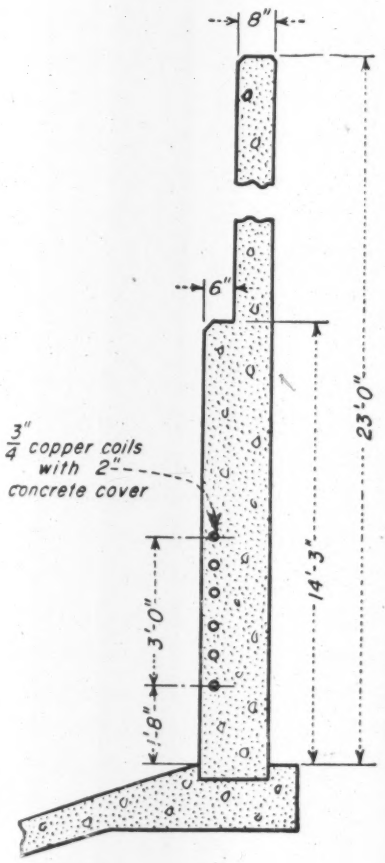


Fig. 2. Sludge heating coils are imbedded near the bottom of the concrete walls of the digesters, a construction similar to that employed for commercial radiant heating systems.

Goodell Prize in Waterworks Field Is Awarded to its 20th Recipient

The John M. Goodell prize, established by *Engineering News-Record* as a memorial to a former editor for the recognition of notable contributions in waterworks science or practice, will be presented to its twentieth recipient at the annual meeting of the American Water Works Association on July 21.

Louis R. Howson, consulting engineer of Chicago, whose selection as winner of this year's award was announced recently, is honored for his paper, "Guides and Checks on Waterworks Operation," published in the January, 1946 issue of the association's journal. The prize is an engraved certificate and a year's income from an endowment fund which amounts to at least $50.

Goodell edited AWWA Journal

Oddly enough, bestowal of the prize on its twentieth recipient comes exactly twenty years after the death of Mr. Goodell in 1927. One of the leaders in the development of technical journalism as editor of *Engineering Record* and prior to that an associate editor of *Engineering News*, Mr. Goodell had a special interest in the waterworks field. In fact, he served as editor of the *Journal* of the American Water Works Association from 1917 to 1921.

After his graduation from Worcester Polytechnic Institute in 1888, Mr. Goodell served on the editorial staff of both the *Record* and the *News*, leaving these posts on two occasions to engage in other engineering activities. In 1903 he was made editor of the *Engineering Record*, retiring from this post in 1912.

Various affairs then occupied Mr. Goodell until his death. He first collaborated with Metcalf & Eddy in producing their three volume work on "American Sewerage Practice." Following this, he helped reorganize the American Concrete Institute and then engaged in the establishment of the American Highway Association. During World War I, he was employment manager for the Emergency Fleet Corporation.

Author of the book, "Waterworks for Small Cities and Towns" (published by *Engineering News* about 1899), Mr. Goodell was widely interested in promoting the dissemination of information on water supply improvements. His leadership in this regard is recognized by the terms of the *Engineering News-Record* memorial prize. Herein it is stated that it shall be awarded annually to that member of the association who has made the most "notable contribution to the science or practice of waterworks development, usually as recorded in the form of a paper published in the association's journal."

Recipients of the award since its inauguration in 1932 are: John R. Baylis; Charles H. Spaulding; Willard T. Chevalier; Frank E. Hale; Mathew M. Braidech; Laurance E. Goit and Harry Hayes, jointly; Vance C. Lischer; Albert G. Fiedler and David G. Thompson, jointly.

Also, Melvin L. Meger and Thomas H. Wieggin, jointly; Paul Weir; Ray F. Goudey; Wilfred F. Langlier and Harvey F. Ludwig, jointly; Noel S. Chamberlin and John R. Glass, jointly; Hans V. Petersen; Carl M. Riedel; and Louis R. Howson.

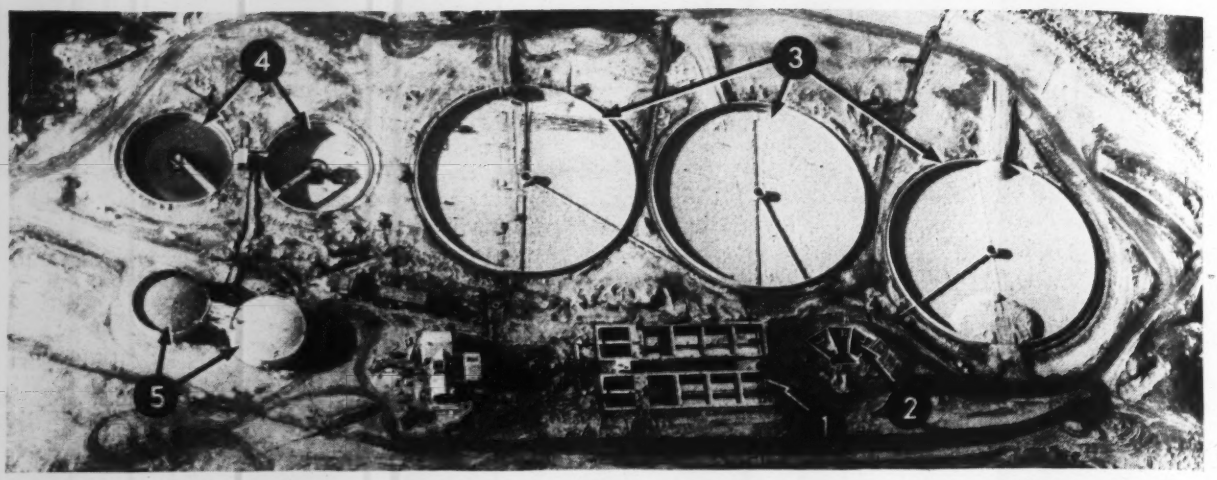


Fig. 1. A 15-ft. gravity drop is used to circulate sewage from the sedimentation tanks (1) into the filter dosing tanks (2) and then into three 175-ft. circular trickling filters (3). From these filters the flow is to two secondary sedimentation tanks (4) from which sludge is pumped to the digester.

Sewage Plant Sells Sludge and Effluent

Leon W. Jackson
Headman, Ferguson & Carollo, Consulting Engineers
Phoenix, Ariz.

***Contents in Brief**—Trickling filters, 175 ft. in diameter, feature the design of a sewage treatment plant put into service this spring for the city of Riverside, Calif. The plant, one of the first to be built in the West in the postwar period, is so arranged that the entire flow through the plant is by gravity. Treated effluent will be used for irrigation purposes and dried sludge sold for fertilizer.*

TAKING ADVANTAGE of its situation in a farming area where there is big demand for fertilizer and irrigation water, the Riverside, Calif., sewage treatment works is in the happy position of finding a ready market for its dried sludge as well as plant effluent.

This new 5 mgd. installation, which is one of the first sewage disposal plants to be built since the war, features the use of 175-ft. dia. trickling filters. The process includes chemical precipitation, primary and secondary sedimentation, standard-rate trickling filtration, two-stage digestion, and post-chlorination.

The 5.0 mgd. (average flow) capacity of the plant is considered more than adequate to serve the present connected population of 41,000. When the connected population exceeds 60,000, the capacity can be doubled by conversion to a high-rate plant through the addition of one primary clarifier, one digester, and a recirculating pump. The plant serves the city of Riverside as well as its suburb, Arlington. It is located 6 miles from downtown Riverside on the Santa Ana River into which the effluent spills when not used for irrigation.

Lagooning is abandoned

Before this new plant was placed in operation, sewage was treated by chlorination and disposal in lagoons located inside the city limits. The state and county health departments felt that this was an undesirable condition and the city agreed. Accordingly, steps were taken toward the building of a complete treatment plant. Plans were drawn, but they had to be put on the shelf until after the war. These plans were revised and brought up to date in 1946 and work on the plant got under way. Construction was completed on the plant this spring. Test runs were made in April and the plant placed in full operation in May, 1947.

Sewage flows to the plant by gravity through two 24-in. outfall sewers, one from Riverside and one from Arlington. After passing through a bar screen and a volume-recording flume, the sewage goes to the rectangular flocculation and sedimentation tanks, which are separated only by perforated baffles. Chemicals for precipitation and odor control are added ahead of these tanks and the sewage is mechanically agitated in the flocculation tank to promote precipitation.

The settling basins can be drained by gravity and they are equipped with mechanical straight-line sludge collectors for continuous removal of sludge. This equipment also operates to remove the scum by bringing it to

DESIGN AND ENGINEERING DATA FOR THE RIVERSIDE, CALIF., TREATMENT PLANT

Treatment: Coarse screening; mechanical grit removal; chemical precipitation; flocculation; primary sedimentation; trickling filtration; secondary sedimentation; post chlorination; two-stage sludge digestion; air drying of sludge; and gas recovery for heating purposes.

Capacity: 5 mgd aver., 8 mgd max., based on present connected population of 41,000. Capacity can be doubled when connected population reaches 60,000 by addition of a primary clarifier, a digester, and a recirculating pump.

Sewage Characteristics: Domestic wastes with suspended solids content of 330 ppm. and a B.O.D. of 300 ppm.

Bar Screen: 1¼ in. opening, mechanically cleaned.

Grit Removal: Bucket type, combined with bar screen.

Chemical Production and Dosage: Automatic control for producing and dosing ferric chloride for precipitation and ferrous chloride for odor control. Chemicals produced by passing a chlorine solution over scrap-iron.

Primary Sedimentation: Two tanks, each in two sections; flocculation section 27x22 ft. and settling basin section is 27x104 ft. Time of retention at 1⅓ aver. design flow 16 min. flocculation and 1.3 hr. sedimentation. Mechanical flocculation. Continuous straight-line sludge and scum removal.

Dosing Tanks: Dosing siphons connected to dosing tank so that each filter receives an equal load.

Trickling Filters: Three filters, each 175 ft. dia. by 6 ft. deep, equipped with rotary distributors. Rock graded from 1½ to 3 in. Surface area 1.66 acres. Design B.O.D. load 330 lb. per acre-ft. of sewage per day.

Secondary Sedimentation: Two units, each 80 ft. dia. and 9 ft. side wall depth, equipped with continuous sludge removal mechanism. Retention time 1.4 hr. at 1⅓ aver. design flow. At present flow will operate in series, one for sedimentation and one for chlorine contact.

Post-Chlorination: Two chlorinators, each of 300 lb. per 24 hr. capacity. Automatic proportioning by means of effluent measuring flume. One or both of these chlorinators can be used for pre-chlorination if desired.

Sludge Digesters: Two units, each 53 ft. in dia. and 24 ft. side wall depth with hopper bottom. Capacity based on 2 cu.ft. per capita with a digestion period of 30 days at a temperature of 85 deg. F. Primary unit has concrete dome and heating coils. Secondary unit has steel gasholder.

Gas Collection: Equipment designed to handle up to 60,000 cu.ft. capacity daily. Gas heats hot-water boiler. Excess wasted.

Drying Beds: 15 beds, with redwood partitions, each 50x110 ft.

Cost: Contract price $513,199.

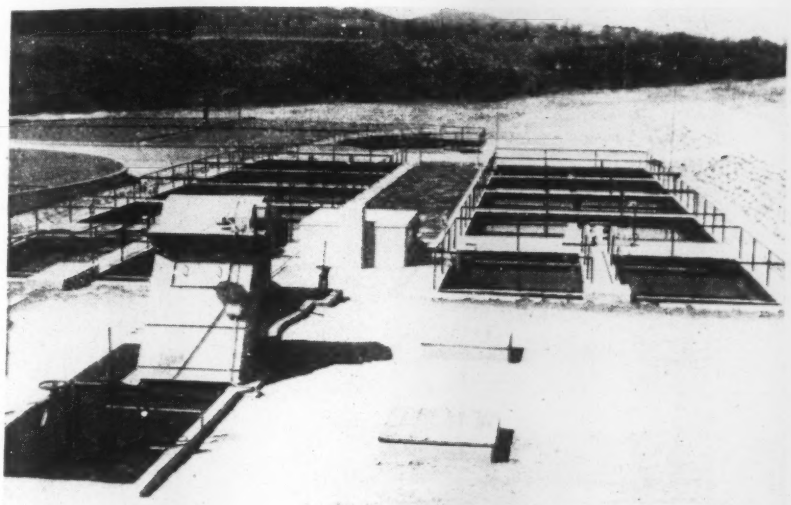


Fig. 2. On entering the plant sewage passes through the bar screen and grit collection mechanism (left center) into the primary sedimentation tanks. Thence it passes through the dosing tanks (rear center) to the filters (left).

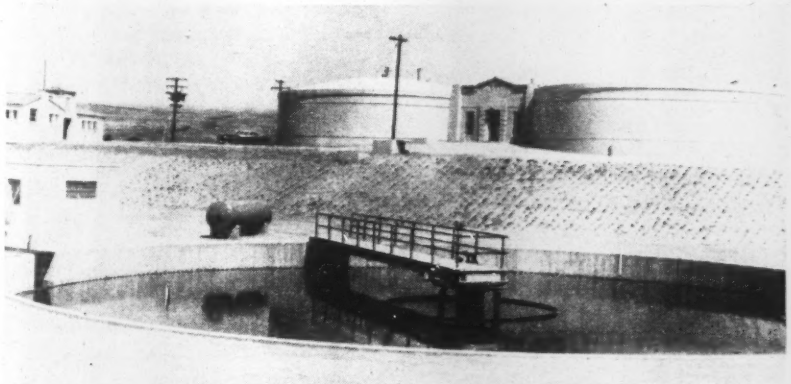


Fig. 3. Circular secondary clarifiers remove filter humus and other sediment which is pumped to the digesters shown in background.

a trough at the end of the settling basin. The scum is periodically transferred to the sludge digesters.

A dosing siphon is provided for each of the three trickling filters. Sewage enters the dosing facilities through a common stilling well and from this well it flows through submerged portholes into three separate basins, one for each filter. From each of these basins it flows over individual adjustable weirs to each of the three dosing chambers. Each siphon is connected to one of these chambers. Rate of flow to each filter can be regulated by the adjustment of the weir heights. Under normal operating procedure, flow to each filter will be uniform.

The filters are identical and they can operate as individual units or in parallel. Each is equipped with a rotary distributor. Filter rock is graded from 1½ to 3 in. in size. Filter design is based on a surface loading of 3 mgd. per acre, 6,000 people per acre-ft. of sewage, and a B.O.D. loading of 330 lb. per acre-ft.

Secondary clarifiers are circular

The secondary clarifiers are so arranged that the settled sludge can be pumped either to the digesters or to the primary sedimentation effluent. By the latter procedure, a continuous supply of nutriment for the filter bacteria can be provided during periods of low flow and a filter of higher efficiency will result.

The secondary tanks are also ar-

ranged so they can be operated in series, parallel, or as separate units. Under normal operation with the present plant loading, the tanks will be operated in series with the first tank being used for sedimentation and the second tank for chlorine contact. Chlorine dosage is automatically controlled by use of an effluent measuring flume.

Each of the two sludge digesters is 53 ft. in diameter and 24 ft. deep with hopper-shaped bottoms. The primary unit has a fixed concrete dome and hot water heating coils; the secondary digester is provided with a steel gas holder. Gas is disposed of by burning in the boiler or by wasting it.

Sludge-drying beds are located at the lowest level of the project. Included at this time are fifteen units with redwood partitions, giving some 2 sq. ft. of area per capita for the present population. Additional area is available for expansion.

Controls centered in three buildings

Controls for the plant are located in a group of three buildings, namely: laboratory, chemical, and boiler building. In the chemical building are the chlorinators and the chemical-producing equipment. Ferric chloride for precipitation and ferrous chloride for odor control is made by passing a chlorine solution over scrap iron. Scrap is available in large quantities nearby in the form of clean baling wire which has the advantage of large surface area. Chemical dosage is automatically controlled in proportion to the flow.

Sludge and effluent sold to farmers

The Riverside plant will follow the policy already in use in many other plants of selling digested and dried sludge to farmers for fertilizer. Riverside is located in a citrus-fruit farming area and it has been found that digested sludge is particularly well-suited for the fertilization of this type of tree.

Water in this section is relatively scarce. Consequently, provision has been made for the plant effluent to be sold to nearby farmers for irrigation. Although this has been considered in many locations, it is believed that the Riverside plant is one of the first in this area where the effluent is so used.

To control psychoda flies in the trickling filters, an application of DDT in a petroleum solvent is made each 15 to 30 days. The DDT is applied for a period of 24 hr. at the rate of approximately 1 ppm. A simple drip arrangement from a drum is used since the required accuracy of dosing does not justify proportional control. It is possible to apply DDT at intervals and thus catch each succeeding generation of flies at an early age.

Some 50,000 cu. yd. of earth work was involved in the excavation for the plant structures. A stone levee for flood protection of the sludge beds involved the use of 3,000 cu. yd. of quarry stone. The three filters required a total of 15,500 cu. yd. of graded rock.

Some 4,000 cu. yd. of concrete was used in the construction, using sulfate-resisting cement to provide a dense, resistant concrete. The concrete was batched at the job site to allow close control and was then mixed in transit mixers.

However, no admixtures were used because a dense concrete was obtained by control of the mix and of the placing. Denseness was required to assure watertight concrete. Although structural design would allow thinner walls, most of the tank walls were made 12 in. thick to facilitate the placing of a relatively stiff mix.

Forms lined with building paper

At the time the plant was built, waterproof plywood for concrete forms was practically unobtainable. As a substitute, oiled building-paper was used to line the forms for part of the exposed concrete. The texture of the finish obtained was termed very satisfactory.

The plant was designed and construction was supervised by Headman, Ferguson & Carollo, consulting engineers, Phoenix, Ariz. M. H. Irvine is city engineer for Riverside. A $513,199 contract for the plant equipment and plant structures was held by the Hogland-Findlay Engineering Co., Long Beach, Calif.

The author was resident engineer on the construction work.

Chlorine Dioxide Aids Taste and Odor Control

Operating successes with chlorine dioxide treatment at several western New York State water plants were reported at the spring meeting of the N. Y. State section of the American Water Works Association at Buffalo.

R. N. Aston, technical assistant of the Mathieson Alkali Works, Niagara Falls, said that this treatment will handle severely fluctuating phenol, algae- and oil-caused tastes and odors, using a steadily-applied optimum amount; it requires no careful chemical control, and it aids maintenance of free residual chlorine throughout the distribution system.

Mr. Ashton cautioned that further experimentation and full-plant trials were needed to determine how phenol and algae-induced tastes and odors may best be handled with water of varying characteristics.

Along the Niagara Frontier 2 to 4 lb. of chlorine dioxide per million gallons have been used with success. Generally, higher amounts are needed in summer to combat severe algae contamination.

During the discussion conducted by R. D. Bates, Buffalo district engineer, New York State Department of Health, it was said that with the initiation of chlorine dioxide treatment a temporary condition of tastes and odors might be caused. Probably this can be attributed to the distribution system in which growths, slime and some tuberculation are reduced by virtue of chemical reactions. Such an annoyance can be eliminated by use of superchlorination followed by gradual introduction of chlorine dioxide.

C. R. Cox, chief, Bureau of Water, N. Y. State Department of Health, pointed out that operators were generally reluctant to try new treatment processes. He urged that new methods —such as chlorine dioxide treatment —be tried over a wide area in order to learn the effect on waters of widely different characteristics.

Delivery of attractive water, Mr. Cox said, is still a big problem.

Water Quality Improvement with Ozone

Victor Hann
Director of Research
Ozone Processes Div., The Welsbach Corp.
Philadelphia Pa.

***Editor's Note**—Present installation of the world's largest ozone generator for Philadelphia water supply focuses attention on the application of this oxidizing agent for taste and odor control. The author, who is intimately identified with the Philadelphia work, tells how ozone is used and what has been accomplished with it in the removal of tastes, odors, and color, and as a sterilizing agent. Included also are data on the range of installation and operating costs.*

PHILADELPHIA has recently authorized construction of an ozonation plant for purification of 36 mgd. of water. In terms of daily ozone generating capacity (1,250 lb.), this will be the largest in the world. This action has focused attention on the application of ozonation for the improvement of water quality.

Ozone is used extensively in Europe primarily for disinfection. The new St. Maur ozone plant at Paris treats 79 mgd. of water. However, it has been only in the last few years that the exceptional value of ozone as an oxiding agent has been fully recognized and exploited.

Ozone is a very active form of oxygen; it is a gas in which three atoms of oxygen are combined in a molecule, rather than two atoms, as in ordinary oxygen. Ozone is an extremely powerful oxidizing agent; except for fluorine, it is the strongest oxidizing agent known. Therein lies its great usefulness in water treatment.

Substances that cause taste, odor and color in water are usually complex organic compounds that can be destroyed by oxidation. This fact has been recognized and treatment methods-such as, oxidation with chlorine (breakpoint chlorination), potassium permanganate, and chlorine dioxide, have been introduced. Ozone is a more powerful oxidizing agent than any of these and oxidizes compounds not affected by the others. Ozone is economical and easy to apply. Elaborate controlts and close supervision are not necessary.

Ozone is an unstable substance and cannot be stored for any length of time. Therefore, it is generated as needed at the waterworks. Air is cleaned, dried and passed through an ozonator, where an electric discharge converts about one percent of the air into ozone. Ozonized air is mixed with the water in a tank where ozone oxidizes the taste-, odor- and color-producing compounds. (See *ENR* Feb. 1, 1940, vol. p 169 for description of equipment).

The required ozone dosage varies widely, depending upon the type and degree of pollution. It is contingent, also, on whether taste and odor reduction, color removal or disinfection is the desired objective.

Tastes and odors can be eliminated

Tastes and odors in surface water are due to the presence of decomposing vegetable or aminal matter, industrial waste products, and oils given off by microscopic organisms. Generally these substances are oxidizable organic compounds. Application of a suitable oxidizing agent destroys them, thereby eliminating tastes and odors. Ozone is particularly effective because:

1. It is the most powerful oxidant used in water treatment; it oxidizes organic compounds not affected by other oxidizing agents. Ozone reacts very rapidly requiring no long period of detention before oxidation takes place.
2. Ozone does not form additional compounds. Thus, intensification of tastes and odors, such as often occurs when chlorine is added to water containing complex organic matter, is not caused.
3. An excess of ozone reverts in a few minutes to ordinary oxygen.
4. The fact that ozone is carried in a large body of air means that aeration takes place simultaneously with oxidation. Volatile compounds in the water contributing to taste and odor are removed, and any volatile oxidation products are likewise removed.

TABLE I—Pre- vs. Post-Ozonation Reduction in Hot-Odor Number

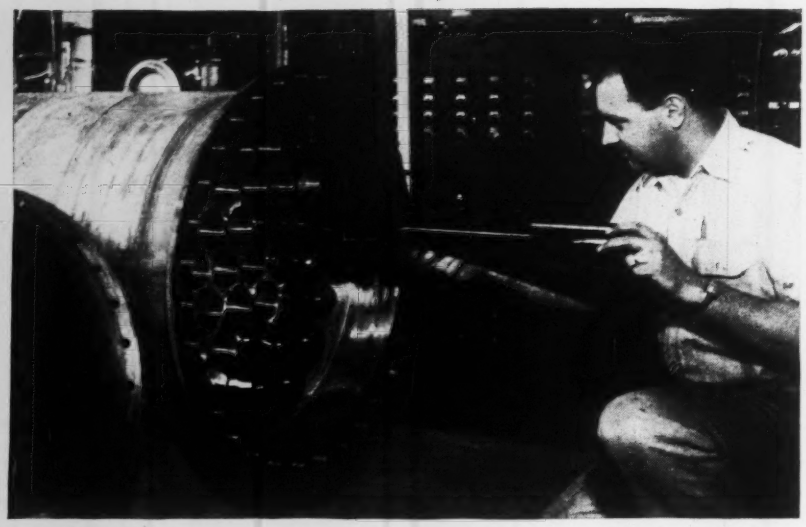
Point of Ozone Application Relative to Coagulation, Sedimentation and Filtration	Ozone Dosage ppm.	Hot Odor Number
Before	No ozone	15
"	1.6	8
"	5.0	7
After	No ozone	15
"	1.0	13
"	2.3	11
"	4.0	10
"	4.5	10
"	6.1	10

Ozone treatment is easy to control. It is possible to treat a "flash" flow without constant attention or testing. Should the ozone dosage be set too high, no "deozonizing" is necessary. If it is set too low, maximum taste or odor reduction may not be obtained, but an under-dosage of ozone does not intensify the taste or odor above its initial value.

It is usually convenient to control the dosage by the ozone residual. In some cases, a direct test of taste and odor is more effective. With ozone, since detention time in the ozone mixing tank is only a few minutes, it is possible to adjust dosage to requirements immediately after a control test is made.

For taste and odor control, ozone may be applied: before any other treatment; after filtration; or before filtration but after coagulation and sedimentation.

The most effective and economical point of application must be determined by test. When ozone is applied



The number of dielectric tubes in the ozone-generating chamber determine capacity of the unit.

after filtration, the dosage is usually smaller, since some of the organic load has already been removed by prior treatment. On the other hand, sometimes better overall taste- and odor-reduction is obtained if ozone is applied prior to coagulation, sedimentation and filtration. Evidently in such cases, oxidation makes it easier to remove taste- and odor-producing compounds by the ordinary processes of coagulation and filtration. In Table I this is illustrated.

From the data in Table I it can be seen that pre-ozonation was more effective in reducing the hot-odor number. An interesting fact that is not revealed in the data is the change in *odor characteristic*. Prior to ozonation the water had a musty, vegetable odor that was very unpleasant even at low concentrations; the ozonated water had a pleasant, faintly sweet odor not noticeable unless the sample was heated.

This is a characteristic change in odor quality. If odor is not completely destroyed by oxidation, that part remaining is almost always a faintly sweet odor, noticeable only on heating the sample. Many "natural" surface and spring waters have the same characteristic. This change in odor character is in contrast to odor reduction by adsorptive treatment methods where odor concentration is reduced with little change in quality. In many cases, it is difficult or expensive to remove obnoxious odors by odsorption, but oxidation changes odor character so that the water is entirely palatable.

In severe problems, ozone treatment can be combined effectively with activated carbon treatment. Water can be ozonated and then treated with powdered carbon or passed through carbon filters. In this way, maximum effectiveness can be obtained with both ozone and carbon, and the most economical combination of dosages can be used.

Color removal is effective

Color in water is due normally to colloidal organic compounds. Such color is readily removed by vigorous oxidation without adjustment of pH or alkalinity. Since no color floc is formed, subsequent coagulation and filtration are not necessary.

In highly colored waters, where alum is used to remove color, it is often difficult or impossible to remove the last 20 to 40 ppm. of color. Under these circumstances, a combination of alum and ozone is often effective and economical. That part of the color most easily removed by alum can be flocculated, settled and filtered out, and the remaining color oxidized by ozone. This combination, beyond reducing the ozone capacity needed and the initial investment cost, insures a low color at all times.

TABLE II—Color Removal with Ozone

Initial Color—27 ppm Average for Ten Different Waters

Ozone Applied	Color Removal
1.0 ppm.	8 ppm.
2.0	12
3.0	16
4.0	18

In general, one ppm. ozone removes more color from a highly colored water than from a less highly colored one. Also, the first part of ozone removes more color than subsequent parts of ozone. Although a color of less than 10 ppm. is seldom desired for drinking water, occasionally for industrial processing, a color of less than 10 ppm. is required.

In Table II is shown average color reduction with ozone for ten different waters.

Residual needed for sterilization

In most applications, disinfection is not a major part of the problem assigned to ozone, but it is usually accomplished at no additional cost in connection with other objectives.

It is well known that ozone is a vigorous germicide. An ozone residual acts in many ways similar to a "free" chlorine residual; bacteria resistant to ordinary chlorination are destroyed; the virus of infantile paralysis is inactivated.

Disinfection of clear water is quite simple. Ozonated air is dispersed into the water in the form of fine bubbles. A few minutes' detention time is sufficient. Treatment is controlled by the presence of residual ozone in the ozone mixing tank effluent. This can be measured by the standard orthotolidin test for chlorine. Since an ozone residual dissipates very quickly, the sample must be tested as soon as withdrawn. Color development reaches a maximum almost instantly; there should be no waiting period between the mixing of the sample and reagent and the color matching. A color equivalent to that produced by 0.1 ppm. chlorine is sufficient to insure disinfection.

Disinfection after filtration

Where disinfection is the object, good engineering practice calls for a water free of turbidity or suspended matter. Therefore, where ozone is the sole germicide, it is recommended that ozone be applied following filtration. In cases where other considerations dictate ozone treatment prior to filtration, excellent reductions in the number of bacteria have been obtained.

TABLE III—Effect of Ozone Residual on Coliform Bacteria in River Water

Ozone Residual ppm.	Number of Samples	Coli-Aerogenes Group Most probable number per 100 milliliters (average)
Untreated Water	25	10,000
Trace to 0.05	43	8
0.06–0.09	10	3
Over-0.9	9	Less than 2.2

The effect of various residual concentrations on the number of coliform bacteria in an otherwise untreated river water is shown in Table III. In this case, bacteriological quality of the ozonated water is equal to that called for by U. S. Public Health Service standard for drinking water.

The dosage required to produce disinfection depends upon the "ozone demand" of the water; that is, the amount of ozone required to produce an ozone residual in the water. Depending upon the quality of the water, the ozone demand may vary from a few tenths ppm. for water relatively free of organic matter to many ppm. for a water highly polluted with organic matter or industrial wastes. For most effluents the dosage required for disinfection is in the range of 1 to 3 ppm.

In cases where it is mandatory that there shall be a chlorine residual in the water leaving the treatment plant, ozone applied before or after filtration will reduce the quantity of chlorine to a small fraction of the amount which would normally be required.

Ozone oxidation has other important effects. Where iron and manganese are in the water, they are oxidized to insoluble forms (provided sufficient ozone has been added). Precipitated iron and manganese can then be removed by coagulation and filtration. No pH adjustment is necessary. Where objectionable quantities of iron and manganese occur, precipitation by ozone limits its use to instances where filtration follows. Otherwise, suspended iron and manganese pass into the distribution system.

Ozone oxidation, like other forms of oxidation, often enhances the coagulation efficiency of alum or iron salts. The exact reason for this is not clearly understood, but the fact remains that less coagulant is necessary after oxidative treatment.

Ozone treatment destroys algae and other micro-organisms, making them more readily removable by settling, reducing the load on the filters.

Since the required ozone capacity varies with many factors such as treatment objective, degree of polution, water treatment capacity, etc., it is difficult to be specific on costs. The installed cost of an ozone plant may vary from less than $10,000 to as much as $25,000 per mg. of water treatment capacity.

Cost of treatment

Operating cost depends largely on the local power rate. Electric energy costs are the major factor in operating expense. Since the ozone plant is electrically operated, labor requirements are low. In the average waterworks it is not necessary to add to the labor force to operate an ozone plant. Modern developments in ozonator design have produced a reliable generator requiring little attention or maintenance. To show normal operating costs for ozone treatment assuming power is available at $0.01 per kw. hr. Table IV has been prepared. In general, the last figures are not cumulative. If color removal is the primary objective, taste and odor reduction and disinfection are by-products of the process. Thus, cost for color removal as given in the table includes the cost of the ozone required to remove taste, odor and bacteria.

TABLE IV—Ozone Operating Cosfs per Million Gallons

Primary Treatment Objective	Usual Range	Median
Disinfection	$1.00–$3.00	$1.50
T. & O. Reduction	1.00– 5.00	2.50
Color Removal	2.00– 8.00	4.00

Ozone treatment is not a panacea. It is, however, a very practical and useful method in cases where water is contaminated with compounds causing severe taste, odor and color. In such cases, ozone treatment has many advantages.

Acting either alone or with other forms of treatment it can be an effective and economical method of removing obnoxious tastes and odors and objectionable color. Since no two waters are alike, it is advisable to study the effect of ozone treatment on individual waters in the laboratory under careful control.

Use of ozone in water treatment has passed the experimental stage in the practical and economical removal of taste, odor, and color. The Philadelphia ozone installation will be in full operation in 1948, and will represent a substantial development in American water treatment practice.

Illinois Plans New Water Supplies

Water-supply planning activities by Illinois municipalities during the past fifteen months promise unprecedented improvements of state public water supplies according to Roland R. Cross, Illinois state director of public health.

While over 98 percent of the urban population of the state is now served by public water supplies, he pointed out that during 1946 the department's division of sanitary engineering reviewed over 275 sets of plans for extensive work proposed for improving the existing supplies and for the construction of 38 new municipal waterworks.

Moreover, a total of 201 sets of plans were approved by the department of public health during 1946 in connection with water-works improvements, this number being more than in any previous year in Illinois history.

In commenting upon these activities, C. W. Klassen, the department's chief sanitary engineer, said that while the new water supplies will occupy a prominent part in future construction, a great majority of the Illinois public water supplies are in need of further treatment so that soft water of low iron content can be furnished for both domestic and industrial uses. The quality of more than 53 municipal supplies is scheduled for improvement.

Nearly seven million persons in Illinois are served by municipal water systems; a bill has been introduced in the legislature will authorize the establishment of minimum qualifications to be met by those responsible for the operation of these systems.

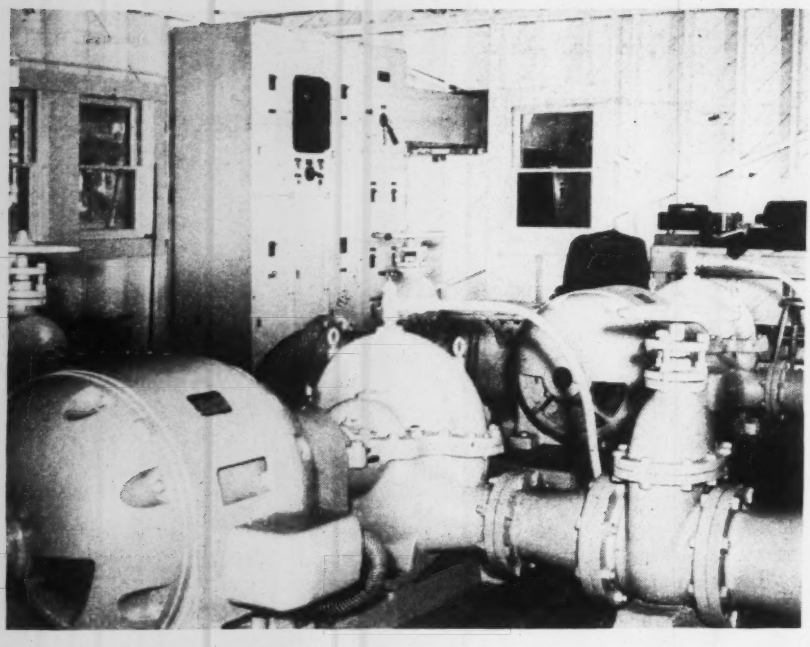


Fig. 1. Two of the three 100-hp. pumping units. In the background is the eight-panel switchboard in which are automatic controls for all pumps.

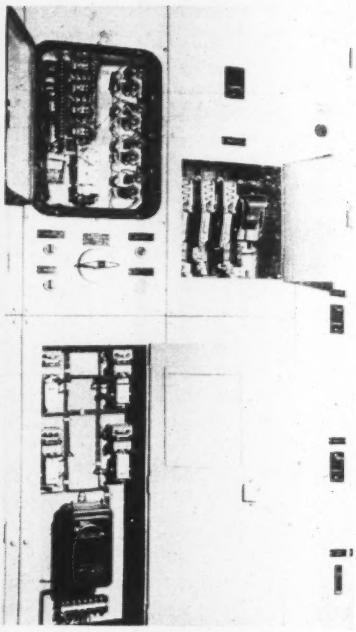


Fig. 2. A compact switchboard contains all of the control mechanism.

Automatic Pumping Plant Controls Center in Eight-Panel Switchboard

A. V. Lynn
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***Contents in Brief**—An automatically controlled pumping plant has been built by the California Water Service Co. for its domestic and industrial water supply system at South San Francisco, Calif. As compared to the obsolete plant replaced, the new plant reduces costs by utilizing off-peak electric power and by eliminating the need for having operators constantly in attendance at the station.*

WATER for domestic and industrial use in South San Francisco, Calif., an industrial city of about 14,000, is supplied from a concrete reservoir located at an elevation high enough to serve most of the city by gravity flow. Water has been lifted to this reservoir by an old-style pumping plant built many years ago. Despite changes and improvements in the old plant at various times, the equipment became obsolete and it was difficult and expensive to keep operators constantly on duty. Hence it was decided recently to replace the old plant with a modern, automatic pumping station. This work was completed last fall; the automatic features have now been thoroughly tested and found to work very satisfactorily.

Off-peak power used

Design of the new plant was based on a study to determine the most economical operating conditions. Substantial savings in pumping costs were possible if advantage could be taken of off-peak electric power available each night from 10:30 p.m. to 6:30 a.m. Maximum water requirements were estimated at 4 mgd. or a rate of 8,333 gpm. if the total quantity were pumped during the eight-hour period of reduced power rates. This pumping rate would have resulted in excessive pressure and high friction loss in the transmission main between pumping plant and reservoir. Since the entire amount could not be pumped at night, the problem was solved by providing three identical pumps with sufficient capacity to meet the maximum demand by operating one pump during the daytime and all three during the off-peak power period.

In Fig. 1 the De Laval centrifugal pumps driven by 100-hp. electric motors which were installed in the new plant are shown. The pumps have a rated capacity of 1,900 gpm.

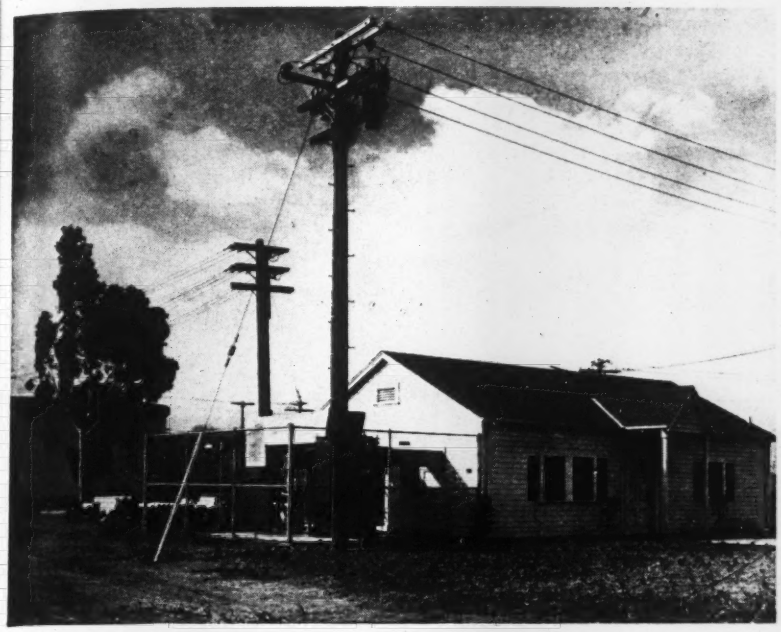

Fig. 3. Plant exterior with 500,000-gal. collecting tank in background, new transformer unit in front center.

each against a head of 190 ft. or they will deliver a total of about 5,000 gpm. at 210 ft. when all are operated simultaneously. The average demand is considerably less than the maximum so that it is often unnecessary to operate more than two pumps at night, thus the third pump frequently acts as a standby unit. Provisions were made in the plant to install a fourth pump if the load increases to such an extent that this additional capacity is later required.

Operating costs were reduced to a minimum by providing automatic control equipment so that an operator need not be in attendance more than a few hours a day. This equipment is mounted in the cabinet type switchboard shown in Fig. 2.

Pumps governed by reservoir level

A Bristol metameter system controls the pumps as the water level fluctuates in the reservoir. The metameter transmitter located at the reservoir sends electric impulses over a leased telephone circuit to the receiver shown in the upper left of the switchboard. Contacts on the receiver switch open or close the pump control circuits depending on the reservoir water level.

Under normal conditions controls are set so that one pump operates whenever the reservoir is not full and circuits for the other two pumps close as water drops 1 ft. and 2 ft., respectively. The two latter circuits are also under time clock control, making the metameter receiver contacts ineffective during the hours that clock controls are open, thus one pump is free to operate at any time and the other two are prevented from running except at predetermined periods. The clock and time delay relays are shown on the switchboard below the receiver. A selector switch provides four operating sequences, including one for future unit, permitting a rotation of pumps for daytime use.

Intakes of all pumps in the plant are served from a 500,000-gal. steel collecting tank in an adjacent well field. In this field are eight wells, each equipped with a motor-driven pump of the deep-well type controlled from the switchboard already described. The eight pumps operate in pairs on four circuits controlled by float switches in the 500,000-gal. tank.

Other float-switch controls in this tank stop the pumps delivering to the reservoir if water level in the collecting tank drops to low level. If this occurs or in case the pumps are stopped by a power failure, relays in the control circuits prevent them from starting simultaneously when service is restored.

Transformers used for the old pump station were made in 1916. As they were still in good condition they could have been used for the new plant. However, due to the high core and load losses, it proved to be economical to replace them with a new three-phase, 750-kva. transformer.

Pipes joined with shutdown

In Fig. 3 the new plant is shown with collecting tank in the background. Installation of piping was complicated somewhat by the fact that there could be no interference with regular operation of the old plant, located about 50 ft. away, until the new pumps were ready to operate. The new discharge line was connected to existing piping by an 18x16-in. tapping sleeve and valve to avoid an interruption of service. A complete shutdown was necessary to connect the new suction line to the tank outlet.

A temporary suction line was laid to the old pumps so that they could be used again if the new plant failed to operate properly. However, they were never used after the new pumps were first started.

F. L. Dodge is vice-president and general manager, H. A. Harris, Jr., engineer of design and the author engineer of operations of the California Water Service Co.

Erosion Pollutes Streams

According to a recent issue of Maryland Tidewater News (Maryland Department of Research and Education), the pollution in Maryland's water courses which is most harmful to aquatic life is likely to be erosion, followed by siltation and sedimentation.

These depleting factors, it is said, are continually changing the ecology of the stream bottom to bring about an adverse effect on plant succession. This, in turn, leads to changes from ideal to less desirable species of aquatic plants and animals.

Sedimentation likewise is constantly at work, upsetting aquatic food change and creating deserts on the waterways as fine particles of soil drop in suspension to cover oyster bars, destroy spawning grounds and fill harbor bottoms.

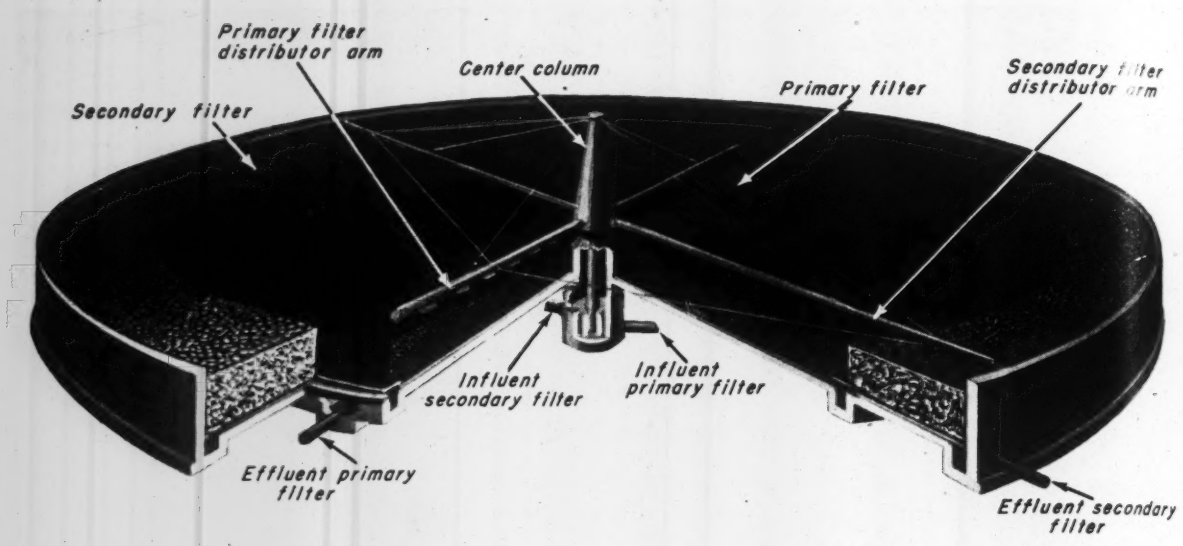

Fig. 1. Two concentric rings of media form the dual-type filter. Influent is applied by means of long and short rotating distributors and effluent is collected in outer circumferential troughs when the base slab is sloped outward.

Dual Clarifier and Filter Structures Simplify High-Rate Treatment Process

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***Contents in Brief**—Combining primary and final settling as well as primary and final filtration in single structures distinguishes one of the latest developments in sewage treatment practice. In the clarifier, operations are separated by means of a vertical partition under which rotating scrapers collect sludge from both compartments. In the filter, concentric rings of media provide two-stage processing; effluent is intercepted in separate troughs located either on inner or outer limits of the media, depending on the slope of the base. For both cases structural elements, piping and site area are at a minimum. Moreover, operating results show that, on the average, suspended solids are reduced 90 percent, and the biochemical oxygen-demand by 95 percent.*

Simplification of high-rate sewage treatment through the use of dual-type units that permit a single structure to perform both primary and secondary functions has been developed. Seven plants embodying this development have been built or are now in construction. Five of these plants handle industrial wastes and two are in use for domestic sewage treatment.

The dual clarifier devised by H. A. Trebler, consulting engineer of Baltimore, Md., is known as the Duo-Clarifier. This unit shown in Fig. 2, a modification of the standard circular clarifier, is separated into two compartments by a vertical partition that extends from above the liquid level down to the mechanism arm supports. One compartment is used for primary settling; the other for secondary settling. A single mechanism is used for raking settled sludge in both compartments to a single central discharge cone.

Feed through central well

The feed to each compartment is introduced through a central well, also divided by the partition wall. Recirculation take-off launders may be provided around the feed well. These are also functionally separated by the vertical partition. Continuous mechanical skimming is furnished where necessary or desirable.

The vertical partition is located usually on a diametric line. However, it may be spaced off-center so that lower overflow rates may be obtained in the secondary compartment.

The double-acting clarifier may be integrated with digesters so that primary and secondary settling and

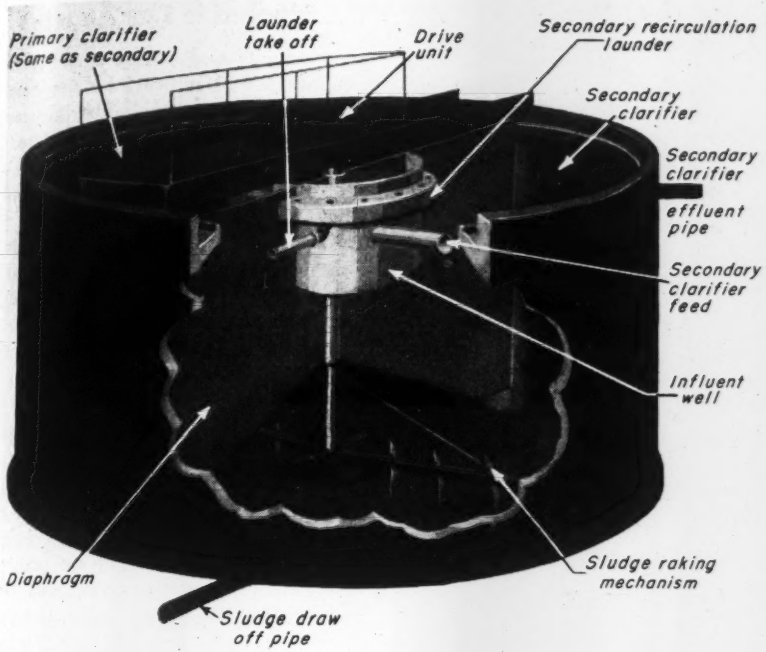


Fig. 2. A diametric vertical partition in the clarifier enables primary and final settling in a single structure. Rotating beneath the division wall, a scraper moves sludge from both processes to the central sump.

sludge digestion may be accomplished in a single unit.

Two-stage filtration in one unit

Primary and secondary filtration processes likewise have been combined to operate in a single unit, which is known as the Duo-Filter. As shown in Fig. 1, this unit consists of two filters concentrically arranged in a single structure and served by a single distributor mechanism. Either the inner or the outer area may serve as the primary portion of the bed. No dividing wall is necessary as mixing of primary and secondary effluents is avoided by use of separate collecting channels, each serving one portion of the bed.

In the arrangement shown, the floor slopes downward from the center, the inner circular channel serving to collect the effluent from the inner primary bed. Secondary effluent from the outer filter ring is collected by the peripheral gutter. An alternate arrangement, in which the floor slopes up from the center, permits collection of primary effluent in a central collector, and secondary effluent in a circular channel at the inner edge of the outer bed.

Sewage is distributed over the two areas by a revolving distributor. Two short arms serve the inner area while two long arms dose the outer ring. The feed to each pair of arms is kept separate by use of the compartmented center column.

Here again, the ratio of primary to secondary filter bed area may be varied to meet local requirements.

Varied flow arrangements

Many arrangements are possible, depending on the recirculation system employed. A typical arrangement and flow sheet are shown in Fig. 3. Here, two-stage biofiltration, as originally carried out at Petaluma, Calif., is provided.

The simplified flowsheet, depicts the process as if the clarifier and filter compartments were in separate structures. Primary filter effluent is recycled back to the primary clarifier and part of the secondary clarifier is returned to the secondary filter. Primary settled sewage flows to both filters, the volume applied to the secondary unit being equivalent to the raw sewage flow.

It has been found in practice that this distribution is superior to other biofilter recirculation schemes, because a better utilization of the total filter volume is provided, and the BOD loading is handled more evenly by both filter units.

Short-circuiting of primary sewage below the partition wall into the secondary settling compartment may be readily avoided by regulating the flow of secondary effluent that is recycled to the secondary filter. As indicated in Fig. 3, this may be accomplished by throttling valve A. This will cause a back-flow beneath the partition wall and thus set up a hydraulic barrier against possible contamination of the contents of the

TABLE I—OPERATING RESULTS FOR MILK WASTE TREATMENT PLANTS

		Wellington, O.	Meadville, Pa.
Flow—gpm.		21	31
Recirculation Ratio—Primary		3.52	1.26
	—Secondary	4.52	2.23
Total Solids	—Raw	1,211	1,182
ppm.	—Primary Eff.	517	781
	—Final Eff.	461	712
Suspended Solids	—Raw	363	330
ppm.	—Primary Eff.	91	61
	—Final Eff.	36	31
BOD—5 day—Raw		648	533
ppm.	—Primary Eff.	96	38
	—Secondary Eff.	33	20

TABLE II—DUAL-TYPE SEWAGE TREATMENT PLANTS IN OPERATION

Plant	Material Handled	Size Duo-Clarifier Dia.	Size Duo-Filter Dia. x Depth
Telling-Belle-Vernon Co. Wellington, Ohio	Dairy Waste	24 ft.	44 x 3 ft.
Rieck-McJunkin Co. Meadville, Pa.	Dairy Waste	20 ft.	44 x 3 ft.
Detroit Creamery Co. Ovid, Mich.	Dairy Waste	24 ft.	two—65 ft. x 4 in.
Kraft Foods Co. Marshall, Ind.	Dairy Waste	24 ft.	40 ft. x 4 ft. 9 in.
Sioux Lookout, Ont.	Domestic Sewage	40 ft.	40 ft. x 3 ft.
Gravenhurst, Ont.	Domestic Sewage	40 ft.	40 ft. x 3 ft.
Reits Meat Products Co. Kansas City, Mo.	Packing House Waste	28 ft.	45 ft. x 5 ft.

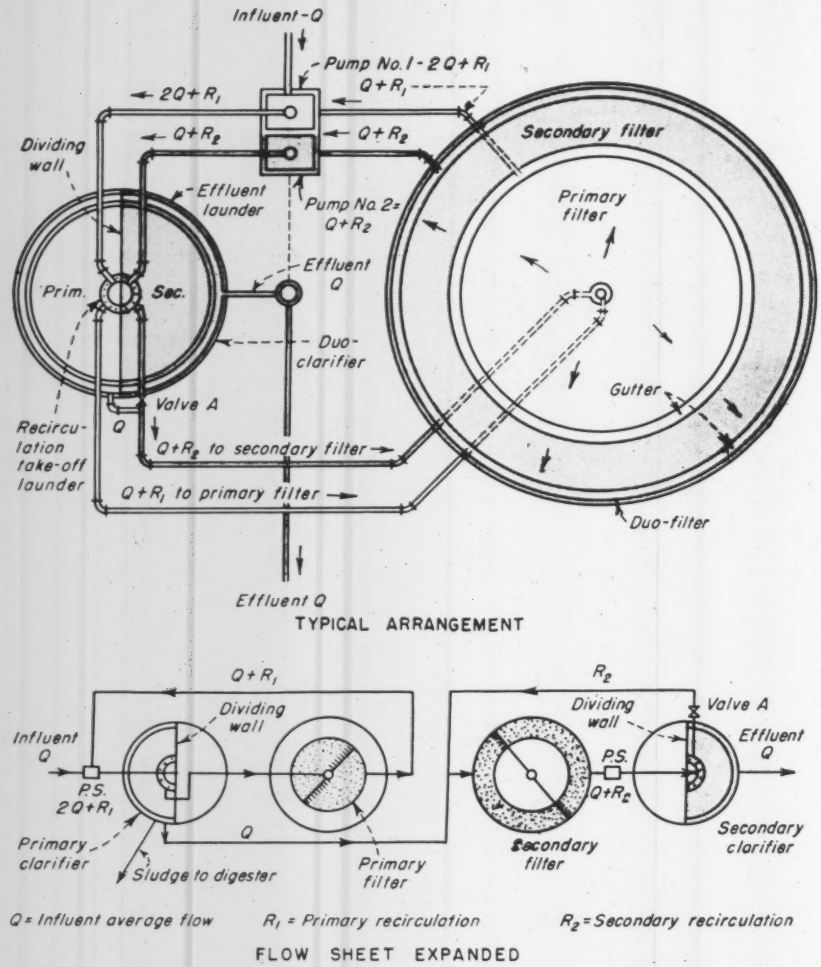


Fig. 3. From a typical arrangement of dual-type clarifiers and filters the distribution of flow can be followed. The flow sheet unfolds primary and final processes as if separate structures were used.

secondary settling compartment.

Two milk waste treatment plants using dual type clarifiers and filters have been in operation since 1943. One, at Wellington, Ohio employs the flow scheme shown in Fig. 3. In the other, at Meadville, Pa., raw waste is applied direct to a primary filter. Primary filter effluent is settled, part of the clarifier effluent being recycled to the primary filter and part being applied to a secondary filter. Secondary filter effluent is settled in a secondary clarifier, part of this effluent being recycled to the secondary filter.

Tests run at each of these plants on daytime composites during 15 day periods in 1944 gave the results shown in Table I. These figures show that at both plants the overall suspended solids reductions were 90 percent and BOD reductions 95 percent.

At the present time (June, 1947) there are seven dual unit type plants in operation, or under construction as shown in Table II.

The chief advantages of the dual type units are: lower installation costs, less maintenance, simplicity and compactness. The cost of both mechanisms and structures is less for dual units than for separate units having an equivalent total area and volume. Also, less piping is required to connect dual units.

Operation of dual units is simpler because of fewer items of equipment. Sludge withdrawal is confined to one clarifier. In a clarifier-digestor combination, all sludge pumping is eliminated, as both primary and secondary sludges are automatically introduced into the digestion chamber.

Industry-Waste Disposal Studied in Los Angeles

How city and county agencies can cooperate with industrial management for the solution of industrial waste problems was outlined at a conference of the southern California section of the Institute of Food Technologists in Los Angeles recently.

Arthur M. Pickett, industrial waste engineer for Los Angeles County, pointed out that before a new industry begins building operations in this area meetings are held with company officials to determine the nature and extent of waste disposal needs. Regulatory measures are discussed and suggestions made for disposal.

Warren A. Schneider, waste disposal engineer for the city of Los Angeles, recounted the steps being taken by the city to prevent turning industries away from the area. He pointed out that some times it was possible to combine several types of waste and thus neutralize them and otherwise make them more amenable to treatment.

Construction of new facilities at the city's Hyperion sewage treatment plant and the installation of a new mile-long outfall sewer will aid disposal of wastes from some 14,000 service stations, 380 laundries, 660 dry-cleaning plants, 120 milk processing plants, 160 plating plants and 30,000 other sources, he said.

Richard Pomeroy, Pasadena consultant, analyzed disposal problems and summarized the procedure for study of such problems by four steps including: (1) whether or not the effluent from a given factory presents a special problem; (2) how to conduct plant operations to minimize wastes; (3) analysis of waste disposal facilities—capacities and type of public treatment plant, comparison of industry's peak load with other existing peak loads; and (4) what can be done to line up with existing requirements of the agencies concerned.

In summing up the presentations, A. M. Rawn, chief engineer and general manager of Los Angeles County Sanitation Districts, who presided over the session, advocated the use of small size garbage grinding units suitable for residential use, but cautioned against installation of large industrial units without first consulting the governing disposal agency.

How To "Feed" Fluorine

Charles R. Cox
Chief, Bureau of Water Supply
Div. of Sanitation, State Department of Health
Albany, N. Y.

***Contents in Brief**—Initiated in 1944 at Newburgh, N. Y. under the sponsorship of the New York State Department of Health a ten-year program is in progress to determine the effect of fluorine applied to a municipal water supply on tooth formation and protection. For comparative purposes the nearby city of Kingston, with "fluorine free" water, is used as the control. Sodium fluoride is being applied at rates ranging from 1.1 to 1.4 ppm. with the desired dosage set at 1.2 ppm. Results of this community-wide experiment are being obtained by means of dental and physical examinations of 500 children in both communities. The annual cost is about $25,000.*

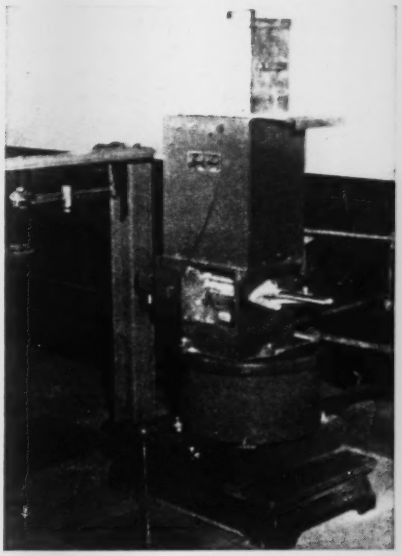


Photo by N. M. Germond
Chemical feeder fitted with dust-proof box is the only equipment needed.

ALTHOUGH it will only cost nine cents per capita per year to test the efficacy of adding sodium fluoride to drinking water for the improvement of dental health, ten years must elapse before conclusions can be drawn. Such a community-wide experiment, which is being sponsored by the New York State Department of Health, is now in progress at Newburgh, N. Y.

The program was undertaken in 1944 after careful study and consultation with a technical advisory committee, during which engineering techniques for the application of the chemical to the municipal water supply and public health procedures for the measurement and evaluation of results on child dental development was organized.

It was necessary, of course, to select two communities—one for the trial and one for the control—of about the same population and served by similar water supplies except for fluorine content. Furthermore, cooperation of the medical and dental professions, municipal officials, and residents was another factor essential to success of the experiment. The cities of Newburgh and Kingston, N. Y. met these requirements. Each has a population of about 30,000 of which nearly 3,200 children are available for study.

The demonstration was started in 1944 by inaugurating the following studies. All school children in the 5 to 12-year group and a sample of children in the 13 to 14-year group are being examined annually to detect the incidence of dental caries. Bacteriological examinations of the saliva from about 400 children in each community are being made to determine the content of *L. acidophilus*, the organism associated with decay of teeth. To provide basic information, dental and physical examinations, X-rays of bone structures, blood and urine analyses are being made at regular intervals of 500 children from birth to twelve years of age. About 100 babies under one year are being added annually to the group.

The water supply of Kingston is secured from impounding reservoirs is cogulated, filtered and chlorinated. Raw water contains 0.06 ppm. or less fluorine, "fluorine free" insofar as dental caries are concerned. Thus the community serves as a satisfactory control for the demonstration.

Water treated at 5 mgd. plant

For Newburgh, water is obtained from two large impounding reservoirs. A 5 mgd. plant provides coagulation with alum, sedimentation and filtration. Pre- and post-chlorination are practiced; activated carbon is used for taste and odor control, and about 85 lb. per million gal. of hydrated lime is added for corrosion prevention. The pH of the effluent is about 8.3.

This water contains from 0.06 to 0.23 ppm. fluorine, the average being about 0.10 ppm. There is no evidence that fluorine naturally present is removed by the treatment processes, although it is known that lime-soda softening removes a portion of the fluorine content. In order to eliminate uncertainty sodium fluoride is applied to filtered water.

Sodium fluoride added

Application of sodium fluoride was started in May 1945. At first the dose was selected to provide a concentration of 0.9 to 1.0 ppm. fluorine in the treated water, but in Oct. 1946 was raised to provide 1.2 ppm.

Sodium fluoride costs about $0.11 per lb. The average dose of about 1.1 ppm. gives a total concentration of 1.2 ppm. This is equivalent to 2.56 ppm. of 95 percent sodium fluoride, or 21.3 lb. per million gal. Therefore, cost of treatment is $2.35 per million gal. or $8.46 for 3.6 mgd. The yearly charge is about $3,000, or $0.09 per capita.

The cost of demonstration is approximately $25,000 per year, including medical and dental studies. However, subsequent routine treatment would involve only purchase of chemical feeders and operation expenses.

Commercial sodium fluoride is available in several grades. The material being used may be described as "light, 95 percent strength sodium fluoride dyed a Nile blue color," and is being purchased from the General Chemical Co., New York, N. Y.

Specifications include certain impurity limitations as follows:

Sodium fluoride	95 percent (min.)
Sodium sulfate	2 percent (max.)
Sodium carbonate	1 percent (max.)
Sodium bicarbonate	1 percent (max.)
Moisture	0.5 percent (max.)
Density, (approx.)	50 lb. per cu. ft.

Sodium fluoride as specified has a low moisture content, is very soluble, non-corrosive and non-hydroscopic, and can be applied by use of standard solution or dry feeders. It is shipped in barrels weighing 375 lb. net.

At Newburgh the powder is being applied by duplicate type N-A Novadel chemical feeders manufactured by the Wallace & Tiernan Co., Inc. These units give accurate results consistently. Sodium fluoride is transferred from barrels to chemical feeders by use of a home-made, portable container. So that no dust is formed this "conveyor" is covered and has a sliding bottom that fits the hopper opening of chemical feeders. Gloves are worn by workmen and gas masks are available for use. However, exercise of care in transferring material from barrels to the portable container controls dust. But the feeding of large quantities of sodium fluoride would be facilitated greatly by use of pneumatic conveyors. In either case care is necessary in handling sodium fluoride because of its toxic nature.

No engineering problems have arisen in treatment of the Newburgh supply. At first a loss of fluorine content was noted as the water passed through the distribution system but after several weeks water contained a substantially uniform fluorine content throughout the system.

Laboratory control is essential

A sampling program has been inaugurated by John F. Kingsley, chief chemist for the Newburgh demonstration. Samples of raw water, two samples of effluent and one sample from the distribution system are examined daily except Sunday. Nine sampling points on the distribution system are used in rotation so that the whole system is covered in nine days. In addition samples of raw and treated water and from the nine points are being collected biweekly for analysis by the laboratory of the New York State Department of Health. Results indicate that concentration of fluorine in treated water varies from 1.1 to 1.40 ppm.

The standard test for fluorine in water gives accurate results when used by experienced chemists. But a foolproof test is needed for routine control.

Some public opposition to the application of sodium fluoride to Newburgh's water supply was anticipated. Yet, wholehearted support is being received from all concerned. This support extends to school children and their parents who are cooperating in the dental and medical studies.

General interest is indicated also by the fact that a number of communities in N. Y. and other states show a willingness to adopt fluorine treatment. However, the state health department has adopted a policy of discouraging the application of sodium fluoride to public water supplies pending collection and interpretation of results, with the exception of a scientific demonstration which is organized with proper safeguards and controls.

Seattle Water System Survey

More than 3,000 cross-connections have been discovered in the city of Seattle's water system by a systematic survey which has been underway since 1945. As no instance of water-borne disease directly attributable to the city water supply has occurred in recent years, officials were unaware of the number and extent of cross-connections until a preliminary investigation was made in 1944 which demonstrated the need for an organized attempt to eliminate these potential health hazards. Inspectors were trained and the survey got under way early in 1945 with governmental, industrial, commercial and waterfront establishments scheduled for scrutiny. The inspection of individual homes was not contemplated. Some time is expected to lapse before all establishments subject to inspection can be visited. However, in the meantime, industries thought most likely to harbor cross-connections have been reinspected. Results to date are as follows:

	Cross Connections	
Year	Found	Broken
1945	1,145	879
1946	1,277	1,317
1947 (to May 1)	715	340
Total	3,137	2,536

The cross-connections broken in the preceding tabulation can be classified as follows: City water connected to sewers—983, to sumps—225, to process vats and tanks—469, to boilers using compounds—116, to lake and canal water—626, to bay water—99, and to wells—18.

Two basic principles were followed by the city's inspectors in the cross-connection survey. In the first place, all physical connections between the city supply and any other water systems were considered potential hazards. Pipes or fixtures that might convey any material affecting quality of the city supply were not allowed. Secondly, an unrestricted air gap was considered the only real protection again backflow. No other arrangement or mechanical device was felt to provide equal security of protection.

Consequently, an attempt was made to eliminate all direct connection to water supplies out of the city's control. Such supplies, used primarily for standby service in industrial plants and fire-protection systems, included well, lake, canal, and bay water. The city's waterfront and docks constitute a major problem in this regard because of the high frequency of fire-protection connections to bay water.

The most dangerous cross-connections found were those between the water supply system and the sewers. In most of these cases, no pollution could occur unless a combination of negative head in the water supply system and high head in the sewers occurred. This could happen during heavy fire use or in case of breaks in the water lines.

The severing of cross-connections was performed by the owners of the industrial property inspected. No plumbing firms or corrective methods were specified or recommended by the city. The need for correction was pointed out either verbally or by letter. In no case was it found necessary to resort to legal proceeding to enforce the recommended cross-connection break.

W. C. Morse is superintendent of the Seattle Water Department. E. J. Allen is sanitary engineer, Seattle Water Department, and is in direct charge of the cross-connection survey.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Atomic Bomb Protection

THE PROBLEM OF REDUCING VULNERABILITY TO ATOMIC BOMBS—By Ansley J. Coales. 116 pp. Princeton University Press, Princeton, N. J. $2.

This book is an attempt to set forth the factors to be considered in answering the question: "Are there practical methods by which mankind can substantially reduce its vulnerability to atomic warfare?" The author does not limit his discussion to the purely physical aspects of reducing vulnerability; also considered are international agreements and military preparedness to reduce the probability of attack.

On the physical side, which is of major interest to the readers of this journal, the author gives available information on the energy of atomic bombs and on the damage to various types of structures and radius of severe damage at Nagasaki and Hiroshima.

The author discusses decentralization but does not put much faith in it as a defensive measure because it can be so easily offset by an enemy through an increase in the number of bombs that are dropped.

Prefabrication Analyzed

HOUSE OUT OF FACTORY—By John Gloag and Grey Wornum. 144 pp. George Allen & Unwin, London, and The Macmillan Company, New York. $3.

THE PREFABRICATED HOUSE—By Raymond K. Graff, Rudolph A. Matern and Henry Lionel Williams. 132 pp. Doubleday & Co., Garden City, N. Y., $2.75.

Both these books are intended mainly for the prospective home purchaser. The former, however, is devoted to explaining to the British people how a great, new and energetic industry could quickly provide all the homes they need. In the demonstration an attempt is made to answer the following questions, using examples from European and American experience: What materials are suitable, what methods can be used, how long will prefabs last, how much will they cost, will they be comfortable and easy to run, and what will they look like?

The second book purports to be a practical guide and lists many items that a buyer should look for when considering buying a home. Problems considered are choosing a house, extras and maintenance, selecting and adapting the site, and safeguarding the investment.

Panel Heating and Cooling

PANEL HEATING AND COOLING ANALYSIS—By B. F. Raber and F. W. Hutchinson. 208 pp. John Wiley & Sons, New York 16; Chapman & Hall, London. $3.50.

RADIANT HEATING—By T. Napier Adlam. 472 pp. The Industrial Press, New York 13. $6.

HOT-WATER HEATING AND RADIANT HEATING AND RADIANT COOLING—By F. E. Giesecke. 260 pp. Technical Book Co., Austin, Texas. $4.

HEATING AND AIR CONDITIONING—Sixth Edition, by John R. Allen, James H. Walker and John W. James. 667 pp. McGraw-Hill Book Co., New York 18, and London. $5.50.

Strictly speaking, panel heating and radiant heating are not synonymous, although the terms are frequently so used. Of the two, the term panel heating appears to be preferable because panels are used to introduce heat into a room. Few systems supply heat solely by radiation. In most cases, heat is supplied partly by radiation and partly by convection.

The above books discuss the advantages and disadvantages of panel or radiant heating, including the application of this principle to summer cooling, describe various systems and give design procedures. Panel heating systems may utilize hot water circulated through pipes embedded in floors, walls or ceilings or through recessed hollow metal panels or plates flush with the interior surface finish. Air may be used, circulated by gravity through the interior framework of the building or forced through supply and return ducts to shallow chambers in ceilings or floors. In some cases, resort has been had to electricity, with resistance wires embedded in wall coverings, floors or walls.

The first of the above books opens with non-technical, descriptive sections, followed by rigorous analytical chapters, and presents graphical methods for facilitating computations. In the second book, emphasis is also placed on the application of radiant heating to actual problems, including step-by-step procedures for the design and installation of systems for panel heating and cooling and snow melting. The third book, in addition to covering the subject of radiant heating, covers hot-water heating systems quite thoroughly. The last book is a revision of earlier editions and has added to it principally sections on panel heating and reversed-cycle refrigeration. The chapter on fuels and boilers, and material on gravity warm air furnace heating and residence air conditioning, have been completely revised.

Evolution of Water Supply

THE STORY OF WATER SUPPLY—By F. W. Robins. 207 pp. Oxford University Press, New York and London. $5.50.

Mr. Robins has brought together more information on the evolution of water supplies up to the close of the eighteenth century than has ever before been published. The closing chapter, "The Nineteenth Century— and After", outlines some of the most notable water-supply projects executed in that period. Reproductions of drawings and photographs supplement the text.

The book opens with chapters on natural water supplies, available for the taking, and on the beginning of water conservation by storage in pits, cisterns and small ponds. New light is thrown on the dew ponds within earth fortifications on ridges in England. Ancient irrigation works and primitive water-lifting devices in Egypt and other countries are considered.

Commendable for interest and comprehensiveness are descriptions of the aqueducts of Palestine, Phoenica, Greece, Rome, the Roman Empire and Roman Britain. Chapters on holy wells and on the water supplies of the Dark and Medieval ages, including monastaries, bring the story down to the leats or open ditches for bringing upland water to large English

towns. At this point in his story the author goes back to the "kanats" or shafts and tunnels for intercepting the underflow in the mid-East and to the well-heads and fountains of early times that supplied water for all comers to drink on the spot or carry home and at the same time gave a chance for gossip and romance. The picturesque water carriers of Paris and other cities are described.

One of the best parts of the book describes the New River Water Co. which for three hundred years brought water from far-away springs to London by way of an open canal, nearly forty miles long. Daniel Defoe wrote that to supply higher parts of the metropolis water was raised by a "great engine" originally worked by six sails but in his day "by many horses constantly working." Laborers and artificers who worked on the construction job were paid a sixpence to a shilling a day.

Water wheels and wood pipes, water divining, village wells and parish pumps each have a chapter.

That the chief interest of the author is antiquarian is shown by the fact that his concluding chapter on The Nineteenth Century—and After, the era of great advances in water-works design and the construction of many thousand water works in most parts of the world, the author mentions only a few of the great water-supply projects executed.

American readers will be amazed and disappointed to find so little information on the early water works of the United States and Canada.—*Reviewed by* M. N. BAKER, *Montclair, N. J.*

Stress and Strain Analyzed

RESISTANCE OF MATERIALS—Third Edition, by Fred B. Seely. 486 pp. John Wiley & Sons, New York 16; Chapman & Hall, London, $4.

MECHANICS OF MATERIALS—Second Edition, by Philip B. Laurson and William J. Cox, 422 pp. John Wiley & Sons, New York 16; Chapman & Hall, London. $4.

Offering well-rounded treatment of the physical behavior of stressed bodies, with numerous examples, these editions have been modernized to increase their usefulness. Changes have been made necessary by the development of new materials and methods and by applications of older materials to new needs. For example, the use of lightweight metals in load-resisting members of high strength-weight ratio, especially those involving thin sections, requires greater study of the effect of buckling.

"Resistance of Material", reset completely, with a large number of new problems added, calls attention to these trends and includes modifications affecting determination of deflections, stress concentrations, stresses on different planes at a point, and vibrational characteristics. The chapter on columns has been brought up to date.

The subject of columns in "Mechanics of Materials" has also been overhauled and is now presented in two chapters instead of one. On the other hand, two chapters on combined stress have been consolidated and Mohr's circle added.

Miscellaneous Notes on Booklets and Reprints

STEEL RAILWAY BRIDGE SPECIFICATIONS of the American Railway Engineering Association are again available in pamphlet form. The new pamphlets include revisions approved at the AREA meeting in March. Copies can be obtained from AREA headquarters at 59 East Van Buren St., Chicago 5.

BASIC AIRPORT DEVELOPMENT POLICIES of the 48 states have been listed in a tabulation prepared by the Airport Division, American Road Builders' Association, International Building, Washington 4, D. C. The tabulation includes sources of funds, whether or not federal aid and state aid is available, taxes on aviation fuel, etc.

New Engineering Books

COMPRESSED AIR HANDBOOK—355 pp. Compressed Air and Gas Institute, 90 West St., New York 6. $3. U. S. A. $3.50 elsewhere.

AMERICAN MIRACLE: The Story of War Construction Around the World—By Van Rensselaer Sill. 301 pp. The Odyssey Press, New York, N. Y. $4.

MATERIALS OF INDUSTRY—Fourth Edition—By C. G. Reen and K. L. Holderman. 623 pp. McGraw-Hill Book Co., New York 18, and London. $2.80.

VECTOR AND TENSOR ANALYSIS—By Louis Brand. 439 pp. John Wiley & Sons, New York. Chapman & Hall, London. $5.50.

WRITING THE TECHNICAL REPORT—Second Edition—By J. R. Nelson. 388 pp. McGraw-Hill Book Co., New York 18, and London. $3.

THE VILLAGE PLAN GLENDALE, OHIO—By Harland Bartholomew. 76 pp. Village Planning Commission, Glendale, Ohio.

HISTORY OF ST. FRANCIS LEVEE DISTRICT OF ARKANSAS—364 pp. St. Francis Levee District, West Memphis, Arkansas.

HOW TO RUN A MEETING—By E. J. Hegarty. 222 pp. McGraw-Hill Book Co., New York 18, and London. $2.50.

ORGANIZATION AND ADMINISTRATION OF GUIDANCE SERVICES—By C. E. Erickson and G. E. Smith. 276 pp. McGraw-Hill Book Co., New York 18, and London. $3.

THE AMERICAN FEDERAL GOVERNMENT— By J. W. Ferguson and Dean E. McHenry. 818 pp. McGraw-Hill Book Co., New York 18, and London. $3.75.

MEASUREMENT OF GEOGRAPHIC AREA—By Malcoln J. Proudfoot. 120 pp. Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

ACCIDENT PREVENTION ADMINISTRATION—By F. G. Lippert. 159 pp. McGraw-Hill Book Co., New York 18, and London. $2.25.

COST ACCOUNTING—By C. F. Schlatter. 699 pp. John Wiley & Sons, New York 16, Chapman & Hall, London. $6.

Reports and Pamphlets

PROCEEDING OF THE 19TH ANNUAL CONFERENCE OF THE MARYLAND-DELAWARE WATER AND SEWAGE ASSOCIATION—Office of Secretary, 2411 N. Charles St., Baltimore, Md.

CHEMICAL CHARACTER OF SURFACE WATERS OF NORTH CAROLINA—By W. L. Lamar. Bulletin #52, North Carolina Department of Conservation and Development, Raleigh, N. C.

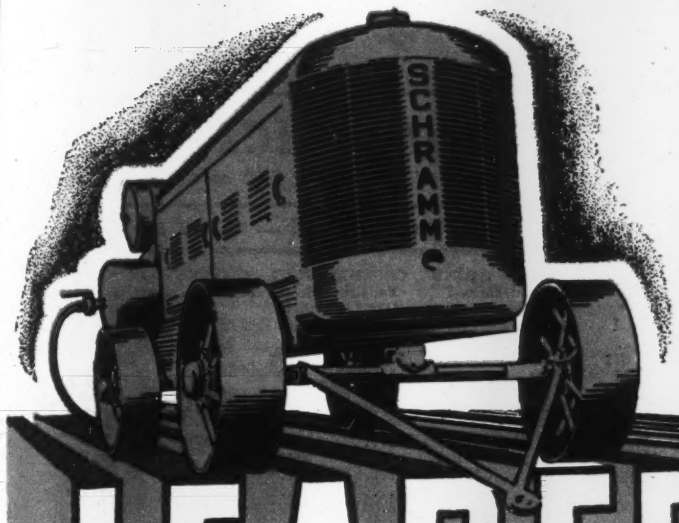
HYDRAULIC RESEARCH IN THE UNITED STATES—U. S. Department of Commerce, National Bureau of Standards, Washington, D. C. Obtainable from the Superintendent of Documents, Washington 25, D. C.

COMPREHENSIVE PLAN FOR FLOOD CONTROL—MERRIMACK RIVER BASIN—CONNECTICUT RIVER BASIN—Corps of Engineers, New England Division, Boston, Mass.

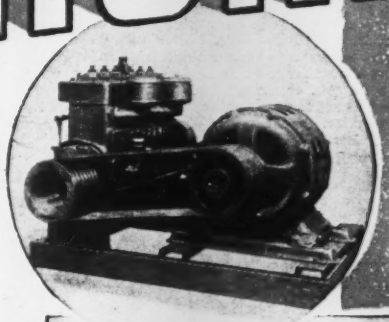
ZONING APPLIED TO PARKING—By C. S. LeCraw and Wilbur S. Smith. The Eno Foundation for Highway Traffic Control, Saugatuck, Conn.

TRUCK AND TRAILER SIZE AND WEIGHT RESTRICTIONS—1947—Research Department, The Four Wheel Drive Auto Co., Clintonville, Wis.

TRAFFIC SURVEY OF OPELOUSAS METROPOLITAN AREA—Department of Highways, Baton Rouge 4, La.



LEADERSHIP



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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT (Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash. dis. not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK (8x8x16-in.; truckload del.; per block)		READY-MIXED CONCRETE (1-2-4, over 50 c.y. del.)
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	
Atlanta	$3.62	$2.77	$2.52	....	....	....	....	....	....	....	$0.1725	....	$10.65
Baltimore	3.46	2.61	2.36	$2.10‡	$2.10‡	$1.60‡	$2.20‡	$2.20‡	$2.20‡	$2.20‡	.145	$0.145*w*	8.35
Birmingham	3.42	2.57	2.32	2.06	2.06	1.63	2.50	2.50	1.00	1.20	.1425	.1425	6.95
Boston	3.88	3.03	2.78	1.50†	1.50‡	1.40‡	1.25‡	1.35‡	....	....	.186	.195*w*	8.50*m*
Chicago	3.40*mm*	2.55*mm*	2.30*mm*	2.50‡*d*	2.50‡*d*	2.75‡*d*	2.50‡*d*	2.50‡*d*	2.00‡	2.00‡	.195	.195*x*	....
Cincinnati*	3.34*v*	2.49*v*	2.24*v*	1.60‡*bb*	1.60‡*bb*	1.50‡*bb*	2.85‡*bb*	2.75‡*bb*	....	....	.17	1.95	8.40*hh*
Cleveland	3.50	2.65	2.40	2.50‡	2.50‡	1.15*ll*	3.20‡	3.20‡	2.45	2.45	....	.20	10.15
Dallas	3.32	2.47	2.22	1.80	1.80	1.60	1.89	1.99	....	....	.0775*p*	....	8.68
Denver	3.93	3.08	2.83	1.85	2.00	1.15	....	....	....	....	....	.2175*w*	9.00
Detroit	3.40	2.55	2.30	2.75	2.75	2.50	2.50	2.50	2.50‡	2.50‡	.16	.17*w*	8.30*kk*
Kansas City	....	....	....	2.00	....	1.40	2.00	2.00	....	....	.16	.16*wy*	8.50*n*
Los Angeles	3.30*eeb*	2.80*b*	2.40*b*	1.55	1.55	1.40	1.40*f*	1.40*f*	1.40*f*	1.40*f*	.125*nn*	.14*nn*	8.75*m*
Minneapolis	3.70	2.85	2.60	1.90*h*‡*j*	1.90*h*‡*j*	1.00*h*‡*j*	1.90*h*‡*j*	1.90*h*‡	....	....	.183*ffo*	....	9.05*kk*
Montreal	....	2.05*r*	1.90*r*	1.78‡*s*	1.78‡*s*	1.10*t*	.95*ct*	1.05*ct*	....	....	.1391	.1515	7.73*ks*
New Orleans	3.28	2.43	2.18	1.82	1.82	1.62	....	....	.90	1.15	.23	....	9.92
New York	4.36‡	3.36‡	....	1.85*de*	1.85*de*	1.30*de*	1.90*de*	1.90*de*	....	....	18/.20*ii*	.16/.18*ccii*	9.15*k*
Philadelphia	3.32‡	2.47‡	2.22‡	2.20‡	2.30‡	2.05‡	1.90‡	1.95‡	1.90	1.90	.20	.20*w*	8.80
Pittsburgh	3.36	2.51	2.26	1.90‡	1.90‡	2.20‡	2.35‡	2.35‡	1.80	1.80	.21*z*	.21*z*	9.85
St. Louis	3.52*o*	2.67*o*	2.42*o*	2.25‡*oh*	2.25‡*oh*	2.25‡*oh*	1.35*ll*	1.35*ll*	....	....	.175	.22*yo*	9.80
San Francisco	3.54*jj*	2.64	2.24	1.56	1.56	1.66	1.66	....	....	....	....	.25*y*	9.05*u*
Seattle	3.35*gg*	3.10	2.80	2.50‡*od*	2.50‡*od*	2.50‡*od*	3.00‡*od*	3.00‡*od*	....	....	.18*o*	....	8.50*v*

‡ Delivered. *b* 20c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* Truck Lots. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* 5 cu. yds. or more. *r* 10% per bbl. off cash 20 days.. *s* 8% sales tax included. † 8% sales tax not included. *u* 10 to 100 c.y. brackets. *v* Add 15¢ for delivered price. *w* Cinder. / Waylite. *y* Haydite. Celocrete *aa* Pumice. *nn* 4 x 8 x12 in. *bb* 5 tons or more. *cc* Also 8 x 18 in. *dd* Prices quoted are LCL. Carload lots not available. *ee* 20c. refund for each returnable bag. *ff* 8 x 8 x 18 in. *gg* 10c. refund for each returnable bag. *hh* Truck loads of 500 c.y. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. ¤ Price at plant. *mm* June price was delivered price. July price is price to dealers. Add 1¢ to 15¢for dealers markup.

* Jan.-June, 1947 prices now available.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount. 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.00 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 20c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.00	$1.95	Ironton, Ohio	$1.95*	$1.90*	Universal, Pa.	$2.00	$1.95
Hannibal, Mo.	2.00	1.95	Northampton, Pa.	1.90	1.85	Waco, Tex. (Plus 9c. tax in Tex.)	1.85	1.80
Independence, Kans.	2.00	1.95	Richard City, Tenn.	2.00	1.95	Montreal City (Discount 10c. per bbl. 20 days)	1.78	1.78
			Steelton, Minn.	2.10	2.05			

* Destination price base effective Feb. 22, 1947

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	....	$0.074	....	$0.0806*h*	....	$0.0781	$0.0806	....
Baltimore	150.00‡	52.70‡	85.00*m*	15.00	$21.00	.06	$0.09	13.00	$23.00	.06	.07	$0.14
Birmingham	....	32.00	....	....	....	....	....	....	....	....	....	....
Boston	85.00	59.00	3.75	17.00	29.50*o*	.0723*o*	.1447*o*	.075*hoz*	.15*hoz*	.07*o*	.0907*o*	.18*o*
Chicago	150.00‡*y*	68.00/70.00*e*‡	2.97/4.10*d*‡	17.50/18.50*b*	25.00/26.00*b*	16.50*bg*	24.00/24.50*bg*	.08/.0824*bh*	.165/.1675 *bh*	.065/.0675*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	....	....	....	....	....	....	....	....	....	....	....	....
Cleveland	150.00	47.00*t*	3.43*v*	19.00	27.00	18.00*g*	30.00*g*	.0875*h*	.18*h*	.10	.1075	.21
Dallas	*l*	40.00	*l*	16.95	29.15	.0686	.1225	20.00	37.60	.05	.0675	....
Denver	....	....	....	....	....	....	....	....	....	....	....	....
Detroit	100.00	63.00*x*	....	20.00*f*	26.00*f*	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	....	40.00	....	17.00	24.00	16.00*g*	23.00*g*	.08*h*	.13*h*	....	.12	.16
Los Angeles	*l*	60.00	*l*	9.50*b*	24.00*b*	10.00*bg*	24.50*bg*	10.00*b*	....	.04*b*	.10*b*	.20*b*
Minneapolis	....	....	2.39*d*	22.00	31.00	17.00*g*	28.00*g*	21.00	31.00	.08	.09	.15
Montreal	....	....	....	16.60*k*	24.25*k*	.1160*kg*	.1485*kp*	.1150*kp*	.1350*kp*	.08*k*	.135*k*	.188*k*
New Orleans	....	....	....	13.50*a*	....*s*	12.50*g*	....*s*	6.75	....*s*	.055	.08	.13
New York	....	....	2.50*n*	20.68	32.85*s*	19.68*g*	38.68*g*	.0857*h*	.1669*h*	.0807	.0855	.1643
Philadelphia	150.00	62.00	4.06	19.00	....	17.00	....	.08*h*	....	....	....	....
Pittsburgh	142.00	39.75	3.90	20.00	30.00	.10	.20	22.00	34.00	.08	.09	.18
St. Louis	....	42.00	....	17.00	23.00	16.00*g*	22.00*g*	.075/.08*h*	.165/.17*h*	.065/.07	.095/.105	.145/.1675
San Francisco	....	54.00*c*	....	13.00	26.50*w*	13.00*g*	....	13.75	....	....	.0525	.1225
Seattle	....	....	....	13.00*i*	29.00*i*	9.50*ig*	....	13.50*i*	17.50*i*	12.50*ig*	.0525*i*	.0625*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2¼ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3 x 4½ x 8½ in. *k* Tax included. † Not used. *m* Per thousand. *n* 2 in., treatment 6 lb. *o* Price at plant. *p* Per 100 gal. *r* February 1943 prices, none later available. *s* Drums not available † Truck deliveries in Greater Cleveland. *w* Shipped in double head wood barrels. *v* 3 in. block. / Truck deliveries in Detroit $75.00. *y* Carload lots. *s* Comparable June prices were $.074 and $.127.

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES–PLATE/	REINF. BARS billet *bef*	RIVETS ½-in. structural/	WIRE NAILS Base *df*	SHEET PILING Base/	STEEL RAILS Per Net Ton: Standard	Light	Re-rolled	TRACK SUPPLIES/: Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.50	$2.45	$5.25	$3.75/4.50	....	$50.00	$57.00	Not	$3.00	$3.65/4.50	$2.80	$6.50
Chicago	2.50	2.45	5.25	3.75/4.50	$3.00	.....	.....	avail-	3.00	3.65/4.50	2.80	6.50
Pittsburgh	2.50	2.45	5.25	3.75/4.50	3.00	50.00	57.00	able	3.00	3.65/4.50	2.80	6.50
Buffalo	2.50	2.45	....	....	3.00	.....	.....	....	....	....	2.80	....
Cleveland	....	2.45	5.25	3.75/4.50	....	.....	.....	....	....	....	....	....
Youngstown	....	2.45	....	....	....	.....	.....	....	....	3.65/4.50	....	....
Detroit	....	....	....	....	....	.....	.....	....	....	....	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.675‡	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.17/3.41‡	3.025‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 percl. *e* Mill lengths. Add 50¢ for cut lengths. */* Per 100 lbs.

IRON AND STEEL PRODUCTS — F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS/ Per 100 lb., base price *u*: 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$4.65‡	$4.75‡	$4.75‡	$.025	$.10	$31.00	$33.00	$2.00	$1.50	$2.12	$3.35
Baltimore	4.25	3.635*l*	....	....	.10	29.00	31.00	1.88	1.42	2.00	4.25
Birmingham	4.05	3.50	3.50	.05	.10	37.50*p*	40.50*p*	1.98	1.49	2.10	....
Boston	4.47‡	4.194‡	3.39*ca*	20 C.L.	.10/.15	26.00	28.00	1.94	1.46	2.05	3.443*k*
Chicago	4.10	3.90	3.90	.05	.05	24.00‡	26.00‡	1.85	1.40	1.96	3.00*a*
Cincinnati*	4.444‡	3.469‡*c*	3.469‡*c*	....	....	35.00‡*z*	36.00‡*z*	1.87	1.41	1.96	3.34*d*
Cleveland	4.311	3.40*v*	....	.025	.10	26.00	28.00	1.84	1.40	1.95	....
Dallas	6.72	5.50	5.50	....	....	29.15	31.35	2.11	1.57	2.22	....
Denver	5.50	4.97*c*	....	....	....	36.00	41.00*q*	2.15	1.60	2.28	....
Detroit	4.42‡	3.591‡	3.591‡	....	.10	38.00‡	42.00‡	1.86	1.41	1.97	3.3193
Kansas City	4.85	3.35*acd*	3.25*aa*	.0	.05	30.00	32.00	1.96	1.48	2.08	3.0826*a*
Los Angeles	5.20*f*	3.025	2.875	.03	.05	23.00	27.50	2.11	1.57	2.24	5.50*d*
Minneapolis	4.434‡	4.224*dy*	4.224*dy*	.0	.10	26.50*k*	28.50*k*	1.98	1.49	2.10	3.47*k*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*hi*	38.70*hi*	2.87	3.54*i*	2.96*im*	73.00*jd*
New Orleans	4.408‡	4.18*o*	....	.05	.10	27.50	29.50	2.00	1.50	2.12	3.125
New York	4.17*r*	3.85	....	....	.15/.20	30.50*st*	32.505*st*	2.13	1.50	2.19	3.00*a*
Philadelphia	3.97	4.24	....	....	....	22.50‡	24.75‡	1.89	1.43	2.00	3.41
Pittsburgh	4.10	4.10	4.10	.05	.10	23.00	26.80	1.77	1.35	1.88	4.50*a*
St. Louis	4.249‡	3.94‡	3.94‡	.0	.05	34.00	36.00	1.87	1.42	1.97	....
San Francisco	4.90	3.83	....	....	....	29.50	33.00	2.11	1.57	2.24	4.50
Seattle	3.368*e*	3.368*e*	....	....	....	43.00*w*	44.00*w*	2.11	1.57	2.24	4.37*e*

‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. customer's spur. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate. *m* Per sq. yd. *o* 5 to 15 tons Base. *p* Deliveries of 5000 sq. yd. or less. *q* ¾ in. standard ribbed. 4lb. Per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extras—1 in., 1¼ in., 1½ in. 10¢; ¾ in. and ⅞ in. 15¢, ⅝ in. 20¢, ½ in. 30¢ ⅜ in. 55¢, ¼ in. $1.30. *v* Under 20 tons. $3.14 for over 20 ton lots. *w* Copper bearing. *y* June price effective Feb. 15, 1947. *z* Copper alloy. *aa* 20 tons base. * Jan.-June, 1947 prices now available.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13–44T: std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM c4–24 Per 1,000 ft., carload lots, f.o.b.: 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTMC 14–41: 12 in.	24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld: Black %	Galv. %	3½ to 6 in., Lap Weld: Black %	Galv. %
Atlanta	$76.28	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	53.2	40.2	50.7	37.2
Baltimore	80.60	.35	.60	2.70	7.25	160.00	200.00	.85	2.25	56.9	43.9	54.4	40.9
Birmingham	71.00	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	53.2	40.2	50.7	37.2
Boston	83.20	.392*uvx*	.756*uvx*	3.465*uvy*	8.7125*uvy*	170.00‡*m*	265.00‡*m*	.53*h*	2.04*h*	55.2	42.2	52.7	39.2
Chicago	81.56	.54	1.04	4.12	....	200.00‡	270.00‡	.65	2.25	59.0*t*	46.0*t*	55.5*t*	42.0*t*
Cincinnati*	80.36	.378	.729	4.00	....	155.00‡	240.00‡	.54	1.98	57.4	44.4	54.9	41.4
Cleveland	82.04	.329	.6345	2.79	7.38	121.00	190.00	.58	2.25	59.65	46.65	57.15	43.65
Dallas	83.78	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	51.3	38.3	48.8	35.3
Denver	88.62	.38	.68	2.84	....	154.00	295.00	.64	2.25	49.4	36.4	46.7	33.2
Detroit	82.04	.455	.8775	3.69	8.50*l*	170.00‡*m*	260.00‡	.50	1.90	57.9	44.9	55.4	41.9
Kansas City	83.12	.345	.625	2.48	7.00	175.00	312.00*m*	.50	1.70	54.7	41.7	51.8	38.3
Los Angeles	95.00	.414†	.745†	2.988	7.47	157.00	260.00	.25	2.50	....	....	....	....
Minneapolis	85.10	.51*mo*	.98*mo*	3.95*mo*	....	.....	.....	1.14*g*	2.70*g*	54.8	41.8	51.9	38.4
Montreal	78.20	.68	1.20	3.94	6.38*e*	.48*p*	.68*p*	72.00*jk*	218.00*jk*	....	....	....	....
New Orleans	78.68	.40	.72	3.06	....	220.00	.....	.55	1.95	52.8	39.8	50.3	36.8
New York	79.80	.55	1.05	4.14	9.74	.....	.....	.90	2.25	56.2	43.2	53.7	40.2
Philadelphia	78.20	.50	.95	3.95	9.75	220.00	275.00	.90*h*	2.75*h*	56.7	43.7	54.2	40.7
Pittsburgh	82.52	.357*m*	.6585*m*	2.70*m*	6.625*m*	126.20	197.40	1.05*h*	2.50*g*	60.0*t*	47.0*t*	57.5*t*	44.0*t*
St. Louis	79.88	.40*n*	.72*n*	2.83*n*	6.53*n*	105.80	212.00	1.20*i*	2.55*h*	56.6	43.6	53.2	39.7
San Francisco	95.00	.4375*d*	.7875*d*	3.15*d*	7.875*d*	159.00*dl*	265.00*dl*	.69	2.85	....	....	....	....
Seattle	96.80	.45*b*	.81*b*	....	....	72.50*c*	.....	.595*f*	1.98*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, Burlington, N. J. (base) $70.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM. C 200–44T. *c* 4-in. *d* SS361-A. *e* 30 in. *f* Less 2% for cash. *g* Culvert pipe. Reinforced, ASTM C76–41. *h* Reinforced. ASTM C75–41. *i* Reinforced. ASTM C76-37. *j* Centri-spun. *k* Per 100 feet. *l* f.o.b. plant. *m* Truck delivery. *n* Less C% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per foot. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13–40. *v* f.o.b. city. *x* 2 ft. lengths. *y* 3 ft. lengths. * Jan.-June, 1947 prices now available.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 34, galv., 16; 1½ in. black, 38, galv., 18½; 2 in. black, 37½, galv., 18. Lap weld — 2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)												
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	5/8"	1/2"
Atlanta	**$65.00**	**$65.00**	**$55.00**	**$55.00**	**$55.00**	**$55.00**	**$75.00**	.....	.....	.....	.....	**$18.60**	$22.70
	85.00	*85.00*	*95.00*	*95.00*	*95.00*	*95.00*	*85.50*	*$85.50*	*$85.00*	.....	.....	.....	.....
Baltimore	**78.00**	**80.00**	**80.00**	**78.00**	**82.00**	**86.00**	**95.00**	.....	.....	160.00	150.00	19.05	23.25
	88.00	*90.00*	*93.00*	*92.00*	*94.00*	*94.00*	*100.00*	*100.00*	*100.00*	.....	.....	.....	.....
Birmingham	**87.50**	**87.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....	110.00	112.50	18.15	22.15
[1]	*92.50*	*92.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*97.00*	*98.00*	.....	.....	.....	.....
Boston	70.00[2]	72.00[2]	66.50[2]	68.50[2]	70.50[2]	74.50[2]	70.25[2]	.....	.....	.....	.....	19.05	23.25
	64.75i	*64.75i*	*62.75i*	*63.25i*	*62.75i*	*62.75i*	*60.50i*	*59.50i*	*59.50i*	*59.50i*	*59.50i*	.....	.....
Chicago [‡]	**80.00**	**80.00**	**75.00**	**75.00**	**75.00**	**85.00**	**85.00**	.....	.....	115.00	115.00	15.60	19.00
[‡]	*85.00*	*85.00*	*80.00*	*80.00*	*80.00*	*90.00*	*90.00*	*90.00*	*90.00*	.....	.....	.....	.....
Cincinnati	**70.00**	**72.50**	**75.00**	**74.00**	**74.00**	**77.00**	**104.00**	.....	.....	79.00	120.00	18.15	22.15
Cleveland [k]	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**105.00**	.....	.....	.....	130.00	150.00	18.50	22.60
[k]	*115.00*	*115.00*	*115.00*	*115.00*	*115.00*	*115.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Dallas	**59.00**	**59.00**	**56.75**	**57.75**	**59.00**	**61.50**	**61.00**	.....	.....	94.75	91.00	15.60	19.00
Denver	*93.50*	*93.50*	*97.00*	*97.00*	*95.50*	*96.50*	.....	.....	.....	.....	.....	11.60	14.15
Detroit	**75.00**	**75.00**	**73.00**	**72.00**	**73.00**	*76.00*	**85.00**	.....	.....	80.00	98.00	18.50	22.15
	93.00	*93.00*	*92.00*	*92.00*	*93.00*	*95.00*	*100.00*	*100.00*	*105.00*	.....	.....	.....	.....
Kansas City [a]	**77.40**	**77.40**	**75.60**	**75.00**	**75.00**	**77.40**	**95.00**	.....	.....	105.00	110.00	13.80	16.80
	79.00	*79.20*	*78.75*	*78.75*	*77.00*	*78.00*	*76.50*	*95.00*	*95.00*	.....	.....	.....	.....
Los Angeles [a]	*78.30*	*78.30*	*79.20*	*80.00*	*78.30*	*78.30*	*91.00*	*91.00*	*80.00*	.....	.....	11.15[gh]	13.55[gh]
Minneapolis [‡b]	102.00[g]	102.00[g]	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.80	16.80
[‡b]	*98.00*	*98.00*	*98.00*	*98.00*	*98.00*	*100.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Montreal [e]	69.00	70.00	64.00	68.00	70.00	75.09	.....	.....	.....	.....	.....	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	**60.00**	**60.00**	**60.00**	**60.00**	**60.00**	**65.00**	**105.00**	.....	.....	100.00	105.00	15.60	19.00
	61.00	*61.00*	*58.50*	*56.50*	*58.50*	*54.50*	*60.00*	*60.00*	*90.00*	.....	.....	.....	.....
New York [‡]	**Range from $79.00 to $85.00**						**105.00/115.00**	.....	.....	.....	.....	19.05	23.25
[‡]	.....	.....	*Range from $92.50 to 97.50*				*95/105.00*	*98/105.00*	*98/105.00*	.....	.....	.....	.....
Philadelphia	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	**110.00**	.....	.....	150.00	150.00	19.05	23.25
	120.00	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	.....	.....	.....	.....
Pittsburgh	**59.40**	**61.80**	**71.35**	**63.60**	**69.45**	**73.10**	**84.85**	.....	.....	130.60	141.00	18.80	22.90
	77.60	*76.70*	*74.70*	*73.90*	*73.80*	*74.85*	*91.35*	*96.85*	*96.85*	.....	.....	.....	.....
St. Louis [j]	**95.00**	**95.00**	**95.50**	**92.50**	**94.50**	**105.00**	**110.00[l]**	*125.00*	*125.00*	120.00	120.00	15.60	19.00
San Francisco [d]	*69.00*	*69.00*	*69.00*	*69.00*	*67.00*	*66.00*	*70.00*	*70.00*	*70.00*	.....	.....	8.40[g]	10.25[g]
Seattle	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. Norway Pine. [‡] Delivered. *a* Yard prices. *b* Retail prices, less than CL 5 M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's ruck or carrier, San Francisco paid). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 500 ft. lots. *k* These are retail yard prices. Lumber is no longer available on the base previously quoted. Less 2% for cash. Truck lots. [2] June price was $110.

Note: Special concrete form grade Fir Plywood, 4′ by 8′ panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼″, $162.50; on ⅜″, $182.50; price includes oiling and sealing charges. For other centers add rail freight increment from table on proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946, Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	76%	76%	$0.195	
Baltimore	70–10%	71–10%	.195	
Birmingham	68%	68%	.15	
Boston	77%	78%	.195	
Chicago	68%*e*	68%*e*	.195	
Cincinnati **	77&10%*a*	77&10%*a*	.195	Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%
Cleveland	67–10–10%	67–10–10–10%	.195	
Dallas	67%*e*	68%*e*	.2075	
Denver	68%	68%	.20	
Detroit	77%	76%	.195	
Kansas City	68.10%*a*	68.10%*a*	.195	
Los Angeles	86%*d*	88%*d*	.2025	
Minneapolis	68%	68%	.19	
Montreal	40–5%*ab*	40–10–5%*ab*	.2125	
New Orleans	....	....	.205	
New York	73%	74%	.265*f*	
Philadelphia	69%	70%	.195	
Pittsburgh	77–10%	77–10%	.1675	
St. Louis	70–10%	70–10%	.20	
San Francisco	66%	73%	.20	
Seattle	59%	60%	.2025	

a Discount from list, Sept., 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers list Sept. 15, 1928. *e* Discount from list of Jan. 29, 1947. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $6.00 per trip. *g* Discount from list of Aug. 15, 1938.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

** Jan.-June, 1947 discounts now available.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C.L. 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.155 –.1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 –.1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 –.2075

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	By Rail — Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.62
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.66
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.60
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	....
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	....
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.67

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6″x8″x8′ Untr.	6″x8″x8′ Tr.	7″x9″x8′6″ Untr.	7″x9″x8′6″ Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.65/2.75*a*	....	3.55/3.70*a*
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	2.25	3.05*ag*	3.00	4.15*ag*
St. Louis	White Oak	1.80	....	2.50	....
	Red Oak	....	2.40*a*	....	3.50*a*
	Sap Pine or Cypress	2.20	....	....	....
San Francisco	Douglas Fir	1.28*ef*	2.56*f*	1.68*bf*	3.36*cef*
Montreal	Birch or Maple	....	1.65	1.04	....

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 7″ x 9″ x 8′. *c* Empty available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$2.75– 3.00
Chlorine cylinders, liquid, per lb. delivered	.0675
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	21.50–38.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.28
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.30
Sulphate of copper, in bbl., per 100 lb.	7.60

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity Common backing	Straight hard	LIME Per ton In paper, Carload lot. Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	$110.00	$116.00	$208.00	$225.00	$290.00	$320.00	23.75*k*	29.75*k*	22.50	17.50	2.75*m*
Birmingham	97.50	104.00	195.00*c*	231.00	.....	.....	19.50	21.50	21.80	17.50	.....
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	18.50	19.50	24.00	18.00	.....
Cincinnati*	150.00*j*	160.00*j*	210.00*jdd*	290.00*j*	.....	.....	27.50	27.50	22.00	19.60	.....
Cleveland	99.50	106.00	195.50	.....	.....	.....	24.00	24.00	19.65	17.15	22.15*ee*
Dallas	.....	83.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	.....
Denver	105.25	119.00	198.25	230.00	263.50	315.35	27.50	.....	34.80*bbe*	28.00*bb*	34.00*bb*
Detroit	126.00	134.00	252.00	285.00	370.00	423.00	24.00*f*	26.50*f*	24.00	22.00	22.00
Kansas City	.....	.....	.....	.....	.....	.....	16.00	18.50	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	18.00	20.50	21.80	18.80	22.80
Minneapolis	136.50*cc*	151.50*cc*	270.40*cc*	151.50*wcc*	.....	.....	21.00*rcc*	.....	30.00*bbe*	23.00*bbe*	30.00*bbde*
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*ag*	.....	294.40*a*	22.16	31.86	12.50*u*	14.00*u*	8.00*u*
New Orleans	.....	.....	.....	.....	.....	.....	22.50	.....	21.20	18.00	14.10
New York	103.90	110.80	152.35*c*	166.70*hn*	.....	.....	25.50	.....	30.00	24.00	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	26.75	17.00*ff*	17.00*ff*
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	24.00	26.00*y*	19.40	16.90	2.85*m*
St. Louis	101.15	112.95	209.60	220.50	273.60	304.00	26.00*s*	25.00*s*	.65*saa*	.50*saa*	.75*s*
San Francisco	124.00	139.50	186.00*dd*	139.50*t*	.....	.....	25.00	.....	22.10	22.10	2.21*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*ccw*	.....	.....	28.50	33.50	27.95*s*	27.95*s*	3.28*m*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *f* Includes $3.50 per M. for truck delivery. *g* 5½ x 8 x 12. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* Truck load or over. *k* $1.00 discount. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12. Speed tile. *o* Per bbl., 200 lb. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* 8% sales tax included. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime recently not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* Corrections: June prices were at July level. * Jan.-June, 1947 prices now available.

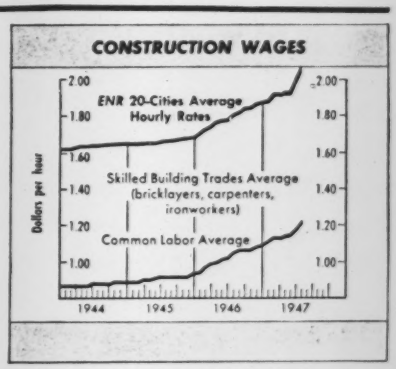
PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$18.75	$27.375	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	18.50	27.50	2.25	3.50	2.75	2.50	3.00	3.00	.50	30.00
Birmingham	18.75	27.375	4.40	4.52	....	2.84	2.70	2.70	.40	34.50
Boston	18.50	27.00	1.75	2.50	2.31	2.00‡*h*	3.30‡*ut*	3.30‡*ut*	.25‡	21.00‡
Chicago	18.50	27.00	....	....	....	1.75‡*h*	2.55‡*h*	2.55‡*h*	....	29.00‡
Cincinnati*	18.50	27.00	....	3.15	1.90	2.21	2.26*o*	2.26*o*	37	32.00
Cleveland	18.50	27.00	3.00	3.00	3.00	2.21	2.26*o*	2.26*o*	.30*y*	33.00
Dallas	18.50	27.00	....	4.05	....	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	18.50	27.50	2.75	4.35	2.50	2.625	2.625*q*	2.625*q*	.365	32.40
Detroit	18.50	27.00	2.00	3.00	1.75	2.25	2.25	2.25	.50	25.00
Kansas City	18.50	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.25	.67	.....
Los Angeles	18.75	27.50	3.20	4.60	4.00	2.80	1.90*e*	*l*	.60	*l*
Minneapolis	18.50	26.13*m*	....	....	....	2.10*im*	2.15*him*	2.15*him*	.37*m*	26.00*rm*
Montreal	.....	.....	2.90*p*	4.20*p*	3.62*p*	2.85	2.58*t*	2.07*t*	.68	1.85*k*
New York	18.50	27.00	3.45	....	3.45	2.10	2.15*o*	2.15*o*	.30*s*	26.00
Philadelphia	18.50	27.00	1.75/2.00	2.40	1.70	2.54	2.94	2.94	.37	26.00
Pittsburgh	18.50	27.00	1.98	2.80	1.90	2.32	2.37*o*	2.37*o*	.37	30.00
St. Louis	18.50	27.00	2.28*s*	2.89*s*	1.96*s*	2.50	2.50	2.50	.45	29.00
San Francisco	18.75	27.25	1.80	2.75*n*	1.35	1.96*x*	2.472*aa*	....	.52	.....
Seattle	18.75	27.50	3.15*m*	3.15*m*	....	2.75*mh*	2.80*hm*	....	.41*m*	35.00*jm*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb. per square. *f* Distributors' price to contractors. *g* 55 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Plus 8% sales tax. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* December, 1942 price. *t* Federal tax included. *u* 90-lb. roll. *v* Truck delivery. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. * Jan.-June, 1947 prices now available.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Electrical Workers	Steamfitters	Common Labor Building	Common Labor Heavy Const
Atlanta	$2.00	$1.65	$1.75	$1.75	$2.00	$1.80	$2.00	$0.75	$0.85
Baltimore	2.25*b*	1.95	2.15	1.625/2.00	1.90	2.00	2.00	1.10	1.10
Birmingham	2.00	1.625	1.75	1.50/1.75	1.875	....	....	.75	.85
Boston	2.15	1.90	1.95	2.25	2.00	2.15	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	2.15	2.15	1.50	1.50
Cincinnati**	2.25	1.975	2.10	2.00	2.125	....	....	1.25	1.15
Cleveland	2.25	2.125	2.25	1.875/2.125	2.125	2.125	2.125	1.50	1.375
Dallas	2.00	1.625	1.75	1.75	1.875	1.875	1.875	.90	.90/1.25
Denver	2.25*b*	1.875	1.70*b*	1.875*b*	2.25	....	....	1.275	1.35
Detroit	2.00	2.025	2.00	2.00	2.10	2.25	2.165	1.425	1.425
Kansas City	2.25	1.90	2.05	2.125	2.25	2.025	1.875	1.325	.90
Los Angeles	2.25	1.90	2.25	2.00	2.50	1.875	2.00	1.25	1.25
Minneapolis	2.075	1.80	2.00	1.85	2.25	2.06	2.00	1.30	1.30
New Orleans	1.9375	1.50	1.875	1.75	1.875	2.00	2.05	.80	.80
New York	2.75*b*	2.50*b*	2.50	2.50*b*	3.00	2.25	2.30	1.50	1.50
Philadelphia	2.50	2.00	2.40	2.25*a*	2.25*a*	2.25	2.25	1.10	1.10
Pittsburgh	2.50	2.25	2.25	2.25	2.25	2.25	2.25	1.15	1.15
St. Louis	2.25	1.95/2.20	2.25	2.40	2.25	2.25	2.125	1.35	1.35
San Francisco	2.25	2.00	2.00	2.00	2.25	2.00	2.25	1.40	1.40
Seattle	2.235	1.935	2.135	1.95	2.235	2.135	2.34	1.535	1.30
Montreal*	1.17	1.06	1.11	1.00	1.17	1.11	1.11	.73	.73



b 7 hr. day. * Cost of living bonus now included in basic wage. *a* June rate approximate. **ENR Skilled Average:** (Bricklayers, Carpenters, Ironworkers) $2.073. **ENR Common Average:** $1.217. ** Jan.-June, '47 prices available.

. . . AND COMPETITIVE TESTS PROVE THAT LaPLANT-CHOATE SCRAPERS DO THE BEST JOB UNDER THE MOST CONDITIONS!

In the final analysis, *any make* of crawler tractor with sufficient horse-power will do a reasonably good job of handling a scraper. But when it comes to selecting *the right scraper*, it's an entirely different story. Some scraper outfits get heaping loads in double-quick time. Others take much longer — even with the aid of a pusher. Some will dump or carry a smooth spread in high gear, while others are slow and uncertain—especially in wet or bulky materials. Some scrapers make efficient use of tractor power — others burn it up by lugging around "an extra yard of dead-weight" that is strictly an extra cost item. The point is—regardless of what tractor you use, there's *a whale of a difference in scraper performance.* And that difference in the scraper alone can have an important bearing on your stripping or material handling costs. That's why more and more smart operators are picking up whatever tractors they can get—and standing pat on LaPlant-Choate Positive Forced Ejection Scrapers. Why LPC? Because competitive tests prove that under the varying conditions of scraper operation, La-Plant-Choate's improved rigs consistently deliver *highest average production at lowest over-all cost.* Just ask any recent LaPlant-Choate owner. LaPlant-Choate Manufacturing Co. Inc., Cedar Rapids, Iowa; 1022 77th Ave., Oakland, Calif.

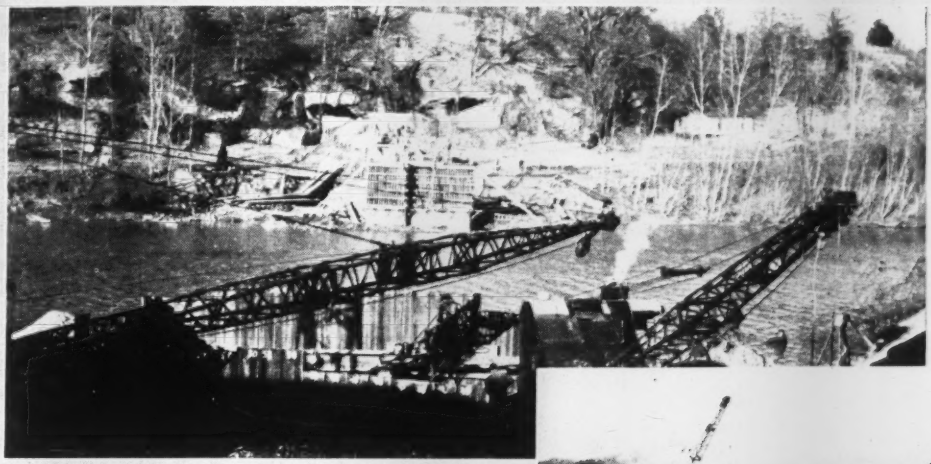
LaPLANT-CHOATE

Positive FORCED EJECTION SCRAPERS

FIRST in value because they're **FIRST** in performance

"We save time with Gulf Quality Products and keep our repair costs low"

says Harry O. Wyse of Lexington, Kentucky



Kentucky Road Oiling Company, Frankfort, Ky., and Harry O. Wyse, Lexington, Ky., have the contract for building the urgently needed Green River Bridge at Aberdeen, Ky. This 1482 ft. span will cost $497,128.00 and involves the driving of 7½ mi. of steel piling, pouring 6,395.7 cu. yds. of concrete, with steel reinforcement.

"As on previous jobs, we're enjoying top performance from our equipment with Gulf quality lubricants and fuels," says Mr. Wyse. "Gulf products helped us keep going at a fast pace right through the winter months, with no loss of time due to changeable weather conditions and high water."

On all types of construction projects, Gulf quality petroleum products play an important part in keeping the job rolling smoothly. Gulf lubricants provide a higher degree of protection —and Gulf fuels help contractors get an extra margin of performance from their mechanized equipment. Result: speedier, more profitable jobs!

Write, wire, or phone your nearest Gulf office and arrange to use Gulf quality lubricants and fuels on your next contract. They are quickly available to you through 1200 warehouses located in 30 states from Maine to New Mexico.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

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GULF

New Aids to the Constructor

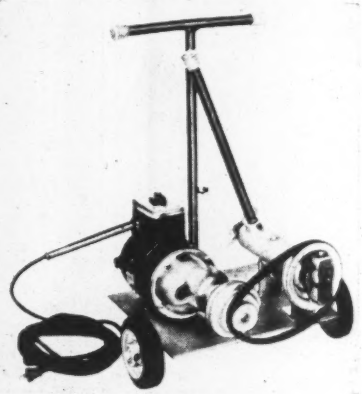
MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

Y-TYPE STRAINER — A streamlined Y-Type strainer for steam, air, gas, oil or water is said to largely overcome back pressure through a new arrangement of interior surfaces, guiding liquids or gases on a course unobstructed by sharp corners or abrupt changes in path of flow. The strainers are self-cleaning by opening of blow-off cock, which flushes grit and dirt out of strainer by line pressure, without shutting off the line or removing the strainer elements.—*Wright-Austin Co., 315 West Woodbridge St., Detroit 26 Mich.*

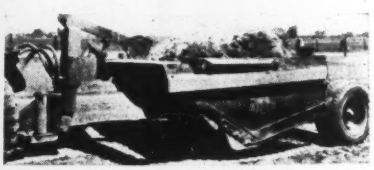
CHEMICAL COATING—Silica aquasol, known as Mertone WB-2, is used as precoat on paper which is subsequently coated with light, sensitive blueprint solutions. Precoat makes possible more uniform coverage by blueprint solutions, provides greater brilliance and color depth and increased legibility to paper. It also minimizes graying effect caused by over-exposure.—*Monsanto Chemical Co., St. Louis 4, Mo.*

PORTABLE FLIGHT CONVEYOR—A new portable flight conveyor for conveying materials at steep inclines is known as Model CFL Tote-All, and is available in 14 ft. and 20 ft. lengths. According to the manufacturer this new conveyor will handle many bulk materials at inclines up to 45 deg. Power is furnished by either electric motor or gasoline engine. Machine will handle up to 60 tons per hr. of 50-lb. per cu. ft. material at a flight speed of 100 ft. per min. Overall frame width is 13¾ in. and trough width is 10¼ in. The conveyor comes mounted on the popular Trail-Hoist (combination trailer and hydraulic lifting device).—*Material Movement Industries, 310 S. Michigan Ave., Chicago 4, Ill.*

TRACTOR-CRANE-DRAGLINE — Hyster has developed a versatile combination crane, clamshell and dragline unit for attaching to rear end of Caterpillar D6 or D7 tractors. For the D6 the rig has a 25-ft. boom with safe load capacity of 6,100 lb., handles a ⅜-yd. dragline bucket, ¼-yd. digging clamshell or ½-yd. rehandling clamshell. The D7 model has a 30-ft. boom with capacity of 6,600 lb., takes a 1½-yd. dragline bucket and ⅜-yd. and ½-yd. digging and rehandling clamshells. Boom is live and swings 240 deg; power is taken from the tractor through a permanently installed transmission. Mounted on tractor rear end, crane rig does not interfere with bulldozer.—*Hyster Co., Portland 8, Ore.*



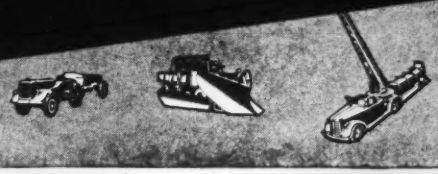
PIPE CLEANER—Full portability, reversible electric operation, greater speed and economy in pipe and sewer cleaning operations and full operator safety are salient features of the "Flexi-Cleaner." Built for plumbing contractors, municipalities and industrial firms the unit puts electric power to work unblocking stopped lines. It is designed to handle "Flexible" steel as well as "Flexible" coiled cleaning rods. —*Flexible Sewer Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.*

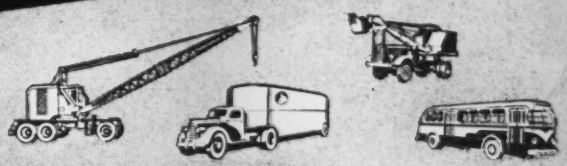


TWO-WHEEL SCRAPER—A two-wheel hydraulic scraper designed for high-speed use with large wheel tractors is made in three sizes—H52 (4.5); H62 (5.6); and H72 (6.9 heaped yds.) —for International 19, Oliver 900, and other heavy-duty wheel tractors. These models have a low center of gravity, independent front apron, and a rear apron that wipes the scraper bowl sides clean as load is dumped. A special hitch assembly eliminates the front

9 GOOD REASONS

for using VICKERS Hydraulic POWER STEERING





1 FINGER-TIP STEERING Finger pressure steers the heaviest vehicle equipped with Vickers Hydraulic Steering. Short, quick, effortless turns ease the job of parking, backing, loading and maneuvering in city traffic. On the open road there is no lag or road wander.

2 HEAVIER FRONT WHEEL LOADING Many steering difficulties resulting from heavy front wheel loading are overcome by Vickers Hydraulic Power Steering. It provides light, easy steering with heaviest front wheel loading.

3 LOWER STEERING RATIOS Present high steering ratios can be lowered substantially with Vickers Hydraulic Power Steering.

4 LESS DRIVER FATIGUE The Vickers Hydraulic Power Steering Unit takes all the steering strain —the driver has none. Anxiety about unsafe tires and hazardous road conditions is relieved.

5 LIGHTER CONSTRUCTION An over-all weight reduction can be made in the construction of steering gears, housings and columns since all stress and shock are borne by the booster unit and vehicle frame.

6 GREATER SAFETY Blowouts, soft shoulders, ruts, cross winds, road obstructions or sudden stops—none affect steering. In event of engine failure or damage to the hydraulic system, steering automatically reverts to direct mechanical action.

7 SHOCKLESS On the road or off the road, the driver feels no road shock or wheel fight.

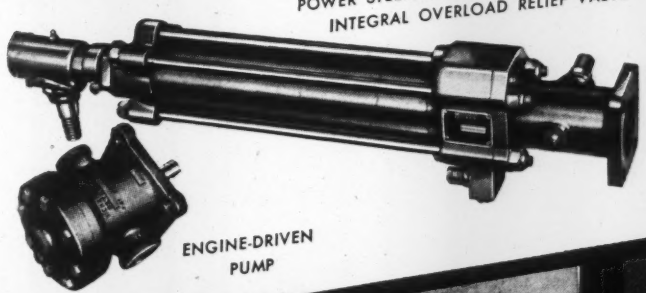
8 LOWER COST Simplified installation and lowered manufacturing costs due to increased production make the price per unit lower now than ever before.

9 ADAPTABLE Only minor alterations needed to apply Vickers Hydraulic Power Steering to new or existing vehicle designs.

Vickers Hydraulic Power Steering has been in successful use for more than 16 years. The redesigned unit with integral relief valve has had more than a year of testing on heavy buses and trucks under most severe operating conditions.

Write for Bulletin 47-30 for full information.

3170



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BUILDERS AND DESIGNERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

YOU'RE SAFE
With *NAYLOR*
On Construction
Jobs

The safety factors built into Naylor light-weight pipe have made it outstanding in the construction field. The exclusive Lockseam Spiralweld provides the reason. Acting as a continuous expansion joint, this structure absorbs shock loads, vibration, expansion and contraction . . . insures closer conformity to topographical conditions without any sacrifice of strength. It makes possible economies with safety in using Naylor light-weight pipe on jobs normally requiring heavier wall pipe. For high and low pressure air and water lines, dredging lines, hydraulic sluicing, de-watering and drainage, sand and gravel conveying and many other applications, it will pay you to specify Naylor light-weight pipe.

Write for Naylor Catalog No. 44

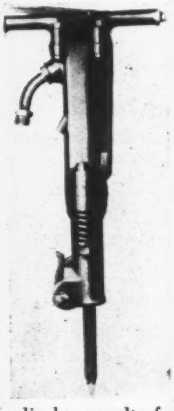
Naylor

NAYLOR PIPE COMPANY
1248 East 92nd Street • Chicago 19, Illinois
***New York Office:* 350 Madison Avenue • New York 17, N. Y.**

trucks of the scraper. Travel speed is limited only by the speed of tractor.—*American Tractor Equipment Corp., 9131 San Leandro Blvd., Oakland 3, Calif.*

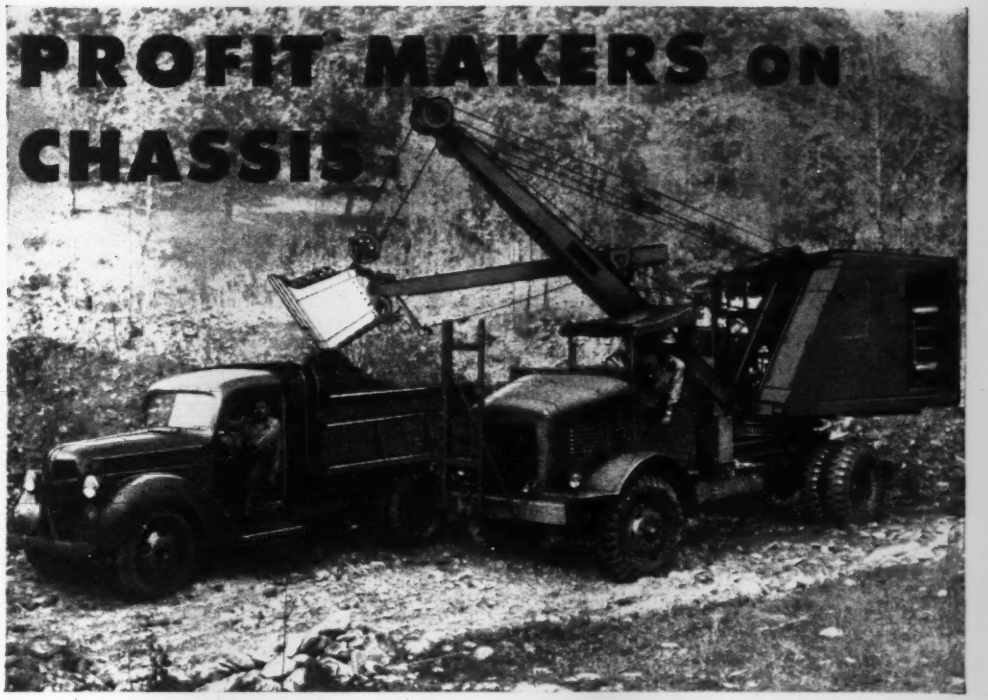
SEPTIC TANK CLEANER—An odorless sanitary cleaner unit has been engineered for septic tank cleaning. It consists of an 1,100 gal. steel tank served by a new Gorman-Rupp self-priming, centrifugal, sewage pump and driven by a 20 hp., 4 cylinder, Wisconsin air-cooled gasoline engine. The entire unit mounts on any standard truck chassis of 158 to 161 in. in length. The fluid in the septic tank is drawn into the pump and jetted back into the septic tank until all solids are held in suspension. Then by simply turning a valve the contents of the septic tank are quickly pumped into the truck tank.—*Gorman-Rupp Co., Mansfield, Ohio.*

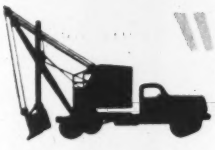
PAVING BREAKER—New 82-lb. machine is suitable for heavy-duty demolition work and general paving breaking jobs. New kicker-port valve used in PB-8 increases efficiency and striking power of machine. Metering device furnishes proper lubrication for all working parts. Adequate oil reserve is provided by a generous size oil reservoir in the handle. Rigid joint between handle and cylinder results from four-bolt construction.—*Ingersoll-Rand, 11 Broadway, New York 4, N. Y.*



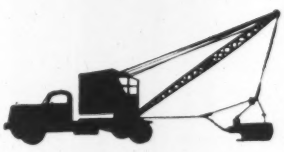
ALUMINUM LADDER — A featherweight model aluminum ladder, designated as Model DLL, weighs slightly over 1 lb. per ft., and is safe for a 250-lb. load. As aluminum will not rot or rust, the ladder can be washed or scalded frequently without impairing its strength. Rungs are corrugated

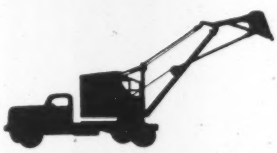
SIX ONE PROFIT MAKERS ON CHASSIS

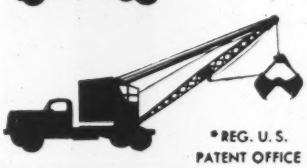




"QUICK-WAY"* TRUCK SHOVELS







*REG. U. S. PATENT OFFICE

When you buy a ***"QUICK-WAY"*** you own six pieces of equipment on one chassis —any one of which can be ready to use in a matter of minutes...shovel, dragline, clamshell, trench-hoe, crane or pile driver.

Regardless of what larger equipment you have, you need ***"QUICK-WAYS"*** too. On many jobs heavy and slow moving equipment is either too slow or can't be moved without waiting for a trailer. This costs money. A ***"QUICK-WAY"*** does these jobs quickly—at a profit. Between jobs you can travel at truck speed —on or off the road.

Rugged simplicity, interchangeability of parts, properly balanced design for truck mounting, easy adjustment and repair, low maintenance—these are additional advantages that cut costs and leave a bigger profit on man-hours and investment. Ask a ***"QUICK-WAY"*** owner; there's one near you.

Model E: 4/10 cu. yd. cap., for mounting on any standard 5-ton truck.
Model J: ¼ cu. yd. cap., for mounting on any standard 1½-ton truck.

Service available from our Distributors, strategically located throughout U. S. and worldwide.

For speed, portability, economy of operation, and adaptability to a wider range of jobs, nothing of comparable size equals a "Quick-Way" Truck Shovel.

"QUICK-WAY" TRUCK SHOVEL CO.

DENVER, COLORADO

First to build power shovels for truck mounting; still the leader after 28 years

★ Need information on steel forms, bins, mixing plants, batchers, or other Heltzel products? See a Heltzel distributor. There's one near you. He can give you fast, complete service on your requirements.

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- BINS, Portable and Stationary
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Heltzel Steel Form & Iron Company, Warren, Ohio

Send me the following:

[ ] B-19 Steel Highway and Airport Forms

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City_____ State_____

(Type of construction usually engaged in)

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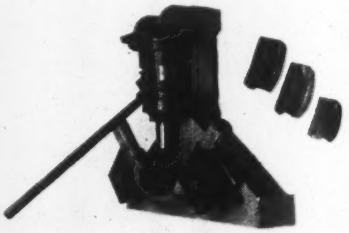
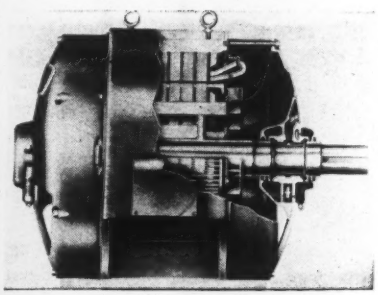
for safe footing. Sizes range from 6 ft. to 16 ft. lengths, and two of the 8, 10 and 12 ft. length ladders can be joined to form an extension ladder.—*Aluminum Ladder Co., Carbis St., Worthington, Pa.*



HYDRAULIC PIPE BENDER—A portable hydraulic Aujax pipe bender is light in weight and simple to use. It comes complete with a hydraulic jack which has screw extensions for maximum bends. Dies and ram extensions for 180 deg. bends can be furnished. The 24 in. unit comes complete with ¾, 1, 1¼, and 1½ in. dies and weighs 150 lb. The 30 in. unit comes complete with 1½, 2, 2½, and 3 in. dies and weighs 100 lb. All parts are electric welded and heavily reinforced.—*Electric Cord Co., 30 Church St., New York 7, N. Y.*



SQUIRREL-CAGE INDUCTION MOTORS—Newly available heavy-duty squirrel-cage induction motors for large-power drives from 100 to 1,000 hp., 1,800 rpm. and lower speeds are designed for drip- and splash-proof construction. Fabricated steel frame shuts out falling particles, makes operation quieter and invites easy cleaning. Company also announces new heavy-duty synchronous motors for constant-speed drives up to 1,000 rpm.—*Electric Machinery Mfg. Co., Minneapolis 13, Minn.*

DRAFTING BOARD COVER PAPER—A new plastic-coated drafting-board cover paper is washable. Its green color minimizes glare and reflection. It lies flat and covers pinholes. Because of its hard, smooth surface, this

NEW PERFORMANCE... NEW WORK CAPACITY ...NEW SIMPLIFIED SERVICING

PERFORMANCE

Instant starting.

Quick pick-up.

Fast maneuvering.

Comfortable operation.

Rugged and dependable.

WORK CAPACITY

Increased lugging ability because of built-in characteristics of General Motors 2-Cycle Diesel engine.

More footing and greater traction to handle larger loads under a wider range of conditions.

Tractor weight balanced for most efficient drawbar and front-mounted equipment use.

SIMPLIFIED SERVICING

Tractor construction permits separate and convenient removal of major assemblies.

Greasing intervals lengthened—1,000 hours for truck wheels, front idlers and support rollers.

Lubrication fittings reduced in number and made readily accessible.

Adjustments easily reached and quickly made.

Get the full story of this great, new diesel tractor from your Allis-Chalmers dealer.

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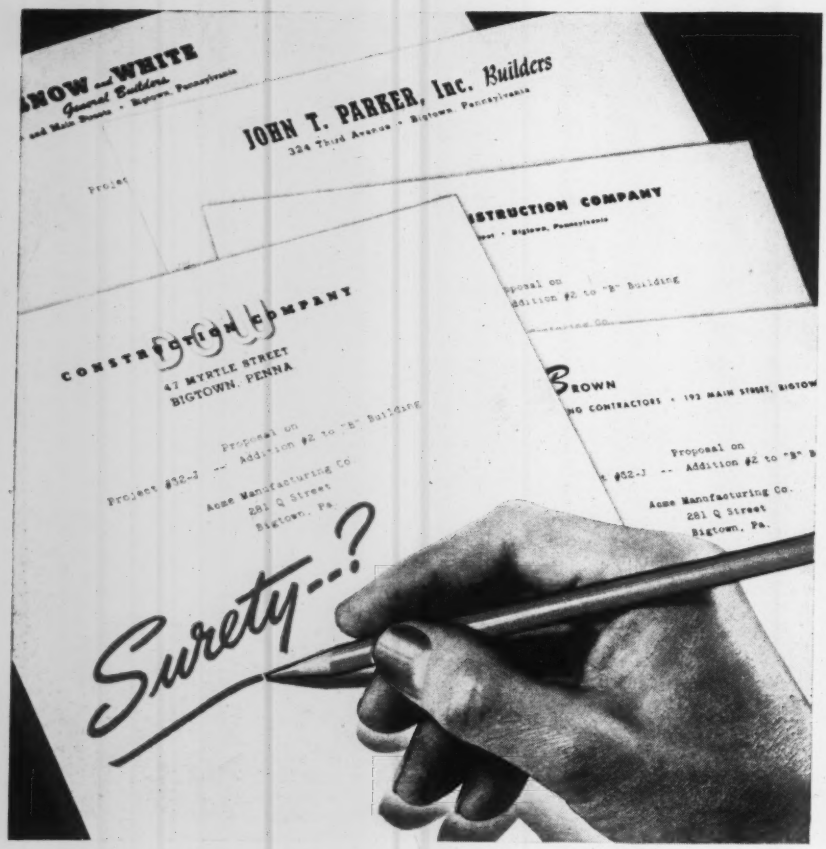

Who gets the Job?

As between several bidders, any one of whom might be awarded the contract on a basis of alternates, the awarding body may frequently be influenced in its decision by factors other than the actual bid.

Among these factors, your own reputation comes first, of course. But if you are bidding on a job where you are not well known, the good name of your *Surety* may very well swing the balance in your favor. Remember the old truth: "A man is known by the company he keeps."

The prestige of a financially sound, widely recognized Surety will help assure your bids of favorable consideration in any part of the country. Furthermore, if your Contract Bond is written by such a Surety, you need supply no further proof of responsibility. Establish your credit *now*—with a Surety whose integrity and financial strength is absolutely unquestioned.

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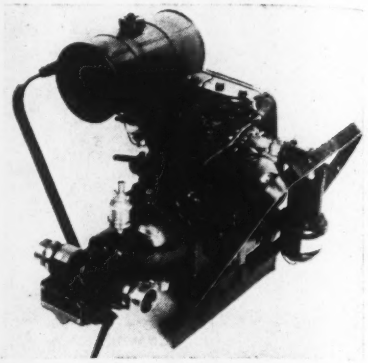
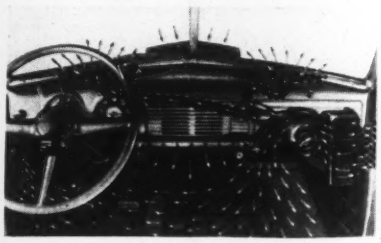
cover reduces scoring "ghosts" on original drawings to a minimum, resulting in clean, sharp tracings.—*Charles Bruning Co., Inc.*, 4745 *Montrose Ave., Chicago* 41, *Ill.*



PORTABLE PUMP—A recent addition to the "MP" line of marine, industrial, and agricultural pumps is the "MP" Duraflex 6600, a portable high-pressure pump carrying rubber impellers. The self-contained power source is a single-cylinder, four-cycle engine, air-cooled and delivering 5 hp. The pump is mounted directly to the engine, and power is transmitted through a splined sleeve. Duraflex 6600 delivers more than 40 gpm. at a pressure of 120 lb. psi, has a suction lift of over 30 ft.—*Marine Products Co.*, 515 *Lycaste Ave., Detroit* 14, *Mich.*

PROTECTIVE COATING—Hydrocide Mastic, a fibrated asphalt compound of plastic consistency, is recommended for application to concrete slabs before installation of steel tanks to prevent corrosion. When applied to continuous film in accordance with standard directions, it produces heavy, elastic, membrane-like coating that serves as barrier against moisture penetration. It is free of coal tar compound and dries in about 48 hr.—*L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.*



TRUCK IMPROVEMENTS—Unprecedented advancements and features for the comfort and safety of the driver, as well as numerous mechanical improvements, are incorporated in the Advance-

BAKER The Favorite . . . FROM COAST TO COAST

BAKER Cable Bulldozers are rapidly becoming the favorite among experienced earth-movers from coast to coast. It's the same story everywhere—BAKER—in the mines, quarries, oil fields, forests and tough construction jobs. It's Baker because of the many superior features and advantages that pay off in higher daily yardage, greater versatility and utility, more work hours per shift and reduced maintenance costs.

Now when you have the privilege of *selecting* equipment —it will pay you to get the facts on Baker Bulldozers and Gradebuilders, cable or hydraulic control. Write for literature or see your Baker-Allis-Chalmers distributor.

BAKER MFG. CO., SPRINGFIELD, ILL.

EASIER OPERATION — Less effort required to operate P.C.U. Brake

MOLDBOARD TILT — Bulldozer and Gradebuilder blades can be tilted in 4 positions

QUICKLY CONVERTIBLE — Bulldozer or Gradebuilder employ same superstructure, control unit and trunions

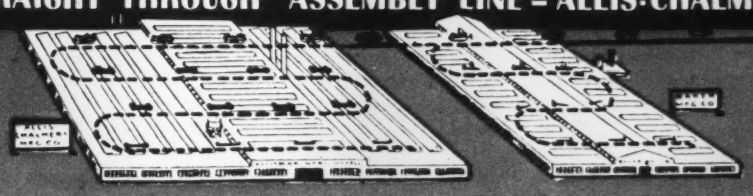
REDUCED CABLE WEAR — "Straight Line" Reeving Large diameter sheaves and drums

HEAVY DUTY CONSTRUCTION — Simple in design, extra heavy construction, all mechanism readily accessible

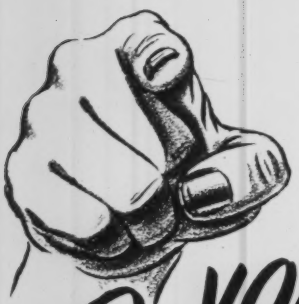
BAKER

Baker Tractor Attachments A-C

"STRAIGHT THROUGH" ASSEMBLY LINE – ALLIS-CHALMERS TO BAKER TO YOU!



The modern Baker plant with its completely equipped fabricating, machining and blacksmithing shops adjoins the Allis-Chalmers crawler tractor plant. When you order an A-C tractor with Baker bulldozer or gradebuilder, your tractor leaves the A-C assembly line, crosses a narrow court and goes on the Baker final assembly line.



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Complete

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RAW WATER AND FINISHED WATER

Herschel Standard and Short Venturi Tubes. *Bulletins 354 and 355.*

Flo-Watch, Type M and Chronoflo Instruments. *Bulletins 318B, 324A and 320B.*

Propeloflo Meters. *Bulletin 350A.*

FILTRATION

Venturi Effluent Controllers. *Bulletins 321B and 325A.*

Rate of Flow and Loss of Head Gauges. *Bulletin 329A.*

Sand Expansion Indicators. *Bulletin 335.*

Operating and Sampling Tables. *Write for information.*

Wheeler Filter Bottom Forms. *Bulletin D4-700.21.*

WASH WATER

Wash Rate Controllers. *Bulletins 321B and 325A.*

Wash Rate Indicators. *Bulletins 329A and 320B.*

RESERVOIRS AND TANKS

Float Operated Liquid Level Gauges. *Bulletin 329A.*

Chronoflo Telemeters for Long Distance Transmission. *Bulletin 320B.*

CHEMICAL FEED PROPORTIONING

Chronoflo Proportioning Control. *Write for information.*

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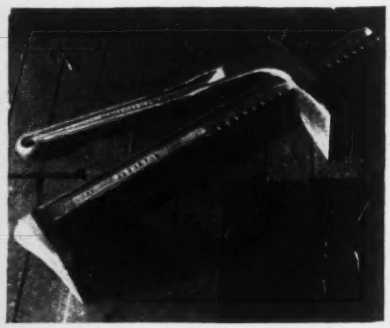
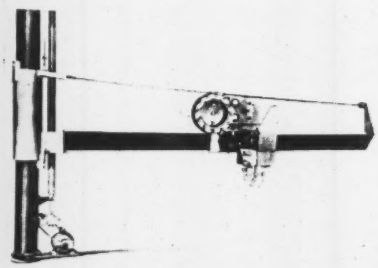
BUILDERS-PROVIDENCE
Instruments

Design line of trucks and commercial cars. The new trucks are produced in a wide variety of models on nine wheelbases for practically every type of hauling. Gross vehicle weights range from 4,000 to 16,000 lb. The vehicles are powered by either the Thrift-Master engine or the equally highly regarded Load-Master engine. Features include: completely welded truck cab; wider bodies; new ventilating system (illustrated); pick-up bodies 50 in. wide; "alligator type" hood design.—*Chevrolet Motor Division, General Motors Corp., Detroit, Mich.*

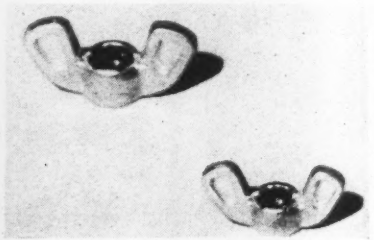


LIGHTWEIGHT MAGNESIUM BRICK TONGS—Weight of tongs is 2¼ lb., whereas a comparable steel unit weighs about 6½ lb. Tension spring and tooth gears permit quick and easy adjustment for all types of bricks and insure safe handling. Available also is a lightweight plasterer's hawk made of magnesium weighing 1¾ lb. Sponge rubber hand cushion is bonded to the wooden handle for greater comfort of the worker.—*Specialty Products Div., The Dow Chemical Co., Bay City, Mich.*



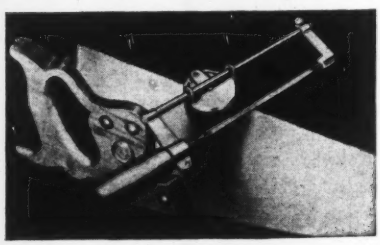
ARC POSITIONER—A radial positioner for welding consists of an 8-ft. automatic welding head, traveling on beam that has vertical movement, with assembly rotating around fixed axis to maximum radius of 20 ft. It is manufactured in three standard sizes, providing 10, 15, and 20-ft. horizontal arc travel. Traveling assembly is Lincolnweld head and carriage.—*Mark F. Gouran, Welding Engineer, 7426 Devon St., Mt. Airy, Philadelphia, Pa.*

RUST REMOVER—A liquid rust remover product is marketed under the name CorOdex. Claims for the new rust remover are that it is amazingly effective on any metal surface, that it will remove even the thickest coat of rust, that it is so penetrating it reaches pin point spots, pits, crevices, cracks or corners and that it can be applied in a minimum of time with a paint brush or cotton swab.—*Allied Products Co., 1133 West Newport St., Chicago 13, Ill.*



WING NUT—A new self-locking wing nut, featuring a red elastic nylon locking collar, has been developed to answer design requirements calling for the convenience of a wing nut, plus the ability to lock in position anywhere on a bolt or stud. Potential applications exist on trucks, industrial equipment and special machinery. They are available in four diameters with both fine and coarse threads.—*Elastic Stop Nut Corp. of America.*

ARC WELDING ELECTRODE—Hardalloy, a new direct current, reverse polarity arc welding electrode, provides weld metal that is highly resistant to impact or abrasive wear. The weld metal is capable of being heat-treated for machining or grinding, and subsequently re-heat treated to restore it to its "as-deposited hardness." The low-hydrogen electrode coating minimizes underbead cracking on hardenable steels. It is available in five sizes from $\frac{3}{32}$ to ¼ in.—*The McKay Co., 1005 Liberty Ave., Pittsburgh 22, Pa.*



SAW FILER—Hand filing guide that enables anyone to sharpen hand saws is said to fill an important need of

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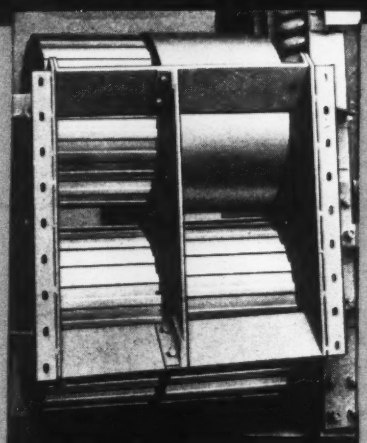
SENSATION OF THE GRAVEL PIT



Feed opening view TwinDual Rolls

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No equal for capacity where crushing must be done. In field tests, under identical pit conditions, production is more than double the output of larger, standard conventional plants.

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  FIRST STAGE—JAW CRUSHER
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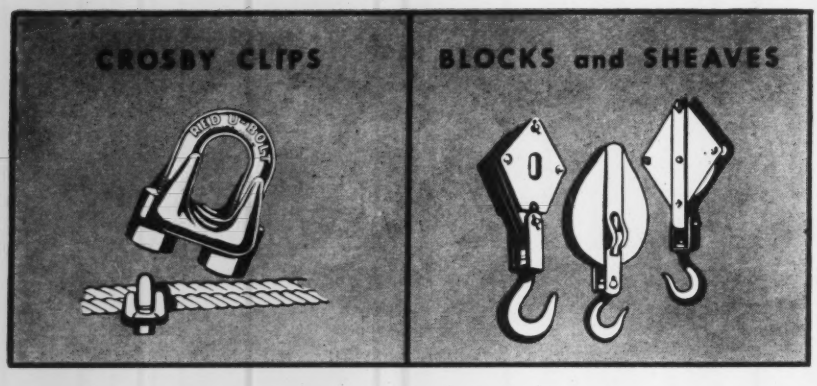

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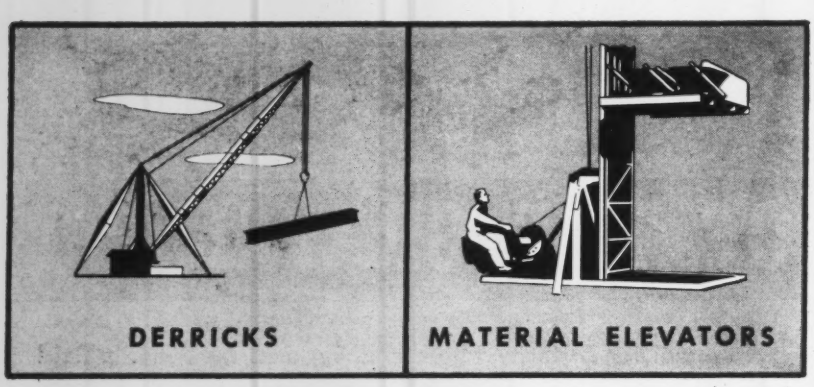

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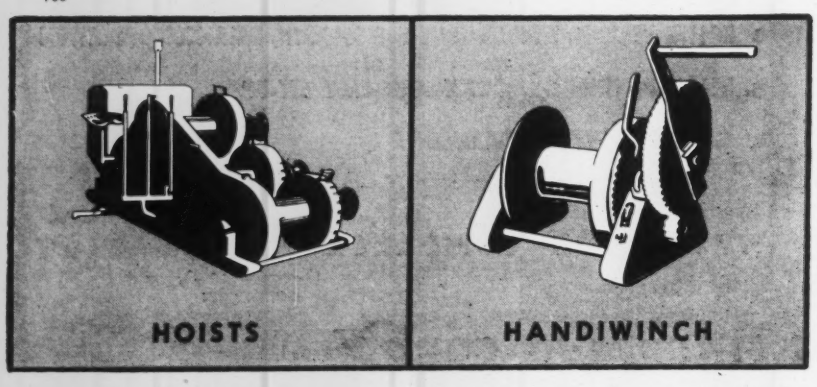
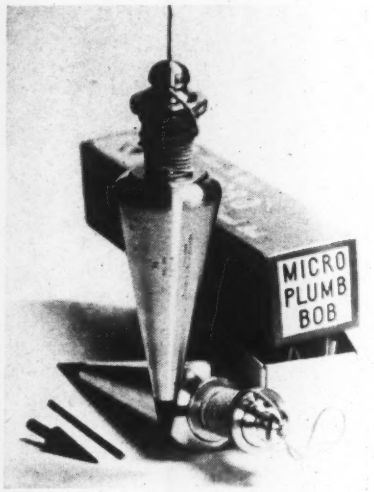


carpenters and home craftsmen as well as large scale builders. Only two positive adjustments are required to set correct pitch and angle for any type of hand saw.—*Speed Corp., 2025 Sanford Blvd., Portland, Ore.*



PLUMB BOB—A quick-acting, precise plumb bob has rotatable reel and special hook on top of neck. Cord is reeled off to approximate length wanted, then slipped into hook which holds bob exactly centered anywhere on cord. The bob can then be minutely adjusted up and down, simply by rotating the spool. Spool has 30-foot capacity.—*Suverkrop Instruments, Box 436, Bakersfield, Calif.*

PUNCH-LOCK KIT—A new Clamp-Master kit that provides a simple, easy and inexpensive method of clamping, splicing, tying, mending and banding offers many possibilities as a maintenance tool for shops and industries. The kit is ideal for hose clamping high or low pressures, maintenance of a general nature and miscellaneous repairs such as splits or breaks in pipes, posts, ladder rails, shovel handles or other similar items—*Punch-Lok Co., Chicago 7, Ill.*

Men and Jobs

Joseph B. Shaw, former city engineer of Utica, N. Y., has been appointed to a 3-year term on the Utica Municipal Planning Commission.

Victor Hoeg has been appointed Winneshiek County highway engineer with headquarters at Decorah, Iowa. He succeeds **Frank W. Arneson,** who will engage in general construction work with his son, Gordon, as partner.

Clair E. Erzinger, who was state highway commission inspector at Ottumwa, Iowa, for five years, has been promoted to resident engineer at Council Bluffs. Mr. Erzinger has been with the highway commission for 15 years.

E. C. Swenson, city engineer at South St. Paul, Minn., has announced the appointment of **Herman Mueller** as his assistant. Until recently, Mr. Mueller has been with the U. S. Corps of Engineers.

Col. Dwight F. Johns has succeeded Col. Edwin H. Marks as division engineer, South Pacific Division, Corps of Engineers. Colonel Johns formerly was in the Office, Chief of Engineers, where he served as assistant chief of engineers for military operations. During the war he served as Chief of Staff for the service of supply, Southwest Pacific Area. He also commanded the combined Operational Service Command and the Advanced Base, U. S. Army Services of Supply in New Guinea. He is a graduate of the U. S. Military Academy, the Command and General Staff School, Ft. Leavenworth, Kan., and the Army War College, Washington, D. C. He also has a degree in civil engineering from M.I.T. On returning from service in the South Pacific in 1944, he was named Commandent of the Engineer School at Ft. Belvoir, Va.

P. H. Barnes, Jr., of Raleigh, N. C., for the last three years surplus property officer with the North Carolina State Division of Purchase and Contract, has resigned to become superintendent of buildings and grounds and director of construction at the State's new mental hospital at Camp Butner, N. C. A civil engineer, he is an alumnus of N. C. State College, Virginia Polytechnic In-

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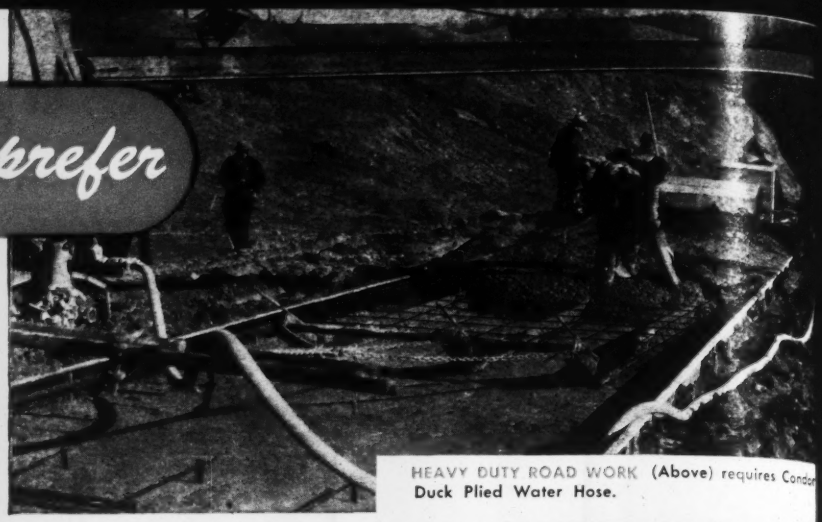
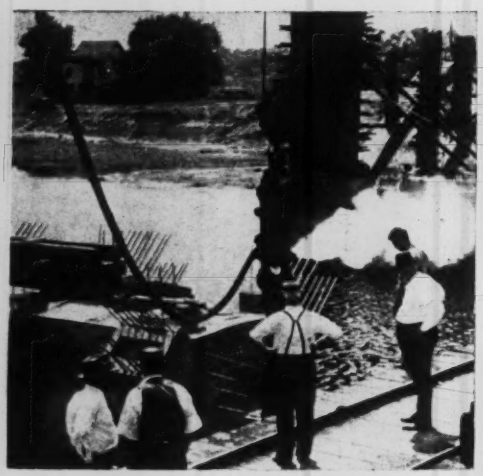


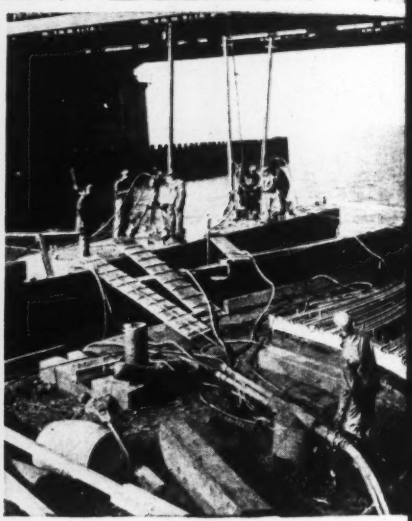
HEAVY DUTY ROAD WORK (Above) requires Condor Duck Plied Water Hose.

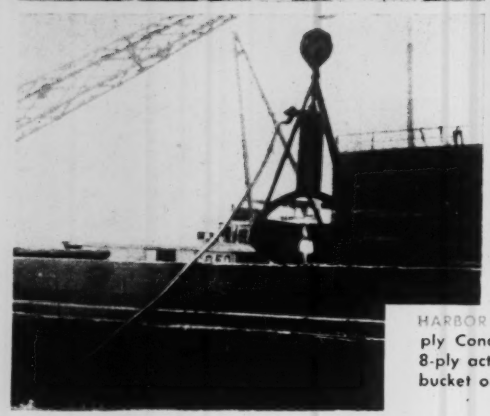
PILE DRIVING (Below) with Condor Pile Driver Hose on a bridge project.

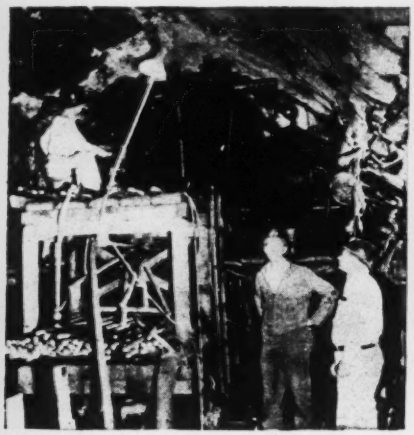
JACKHAMMERS—Right: Condor Homo-Flex Air Hose, lighter, easier to handle on Jackhammers. Exceptionally resistant to ragged rock punishment.



DAM EXCAVATION—Above: Draining low portion of a dam excavation, 300 G.P.M. against 90' head. Manhattan Suction Hose stands up on big jobs.







HARBOR WORK—Left: 2" 6-ply Condor Hydraulic Hose, 8-ply activating a clam shell bucket on a dredge.

NANTAHALA TUNNEL—Condor 2" Tunnel Air Hose and Homo-Flex Air Drill and Water Hose used in driving a 5-mile river-diversion tunnel in Nantahala, N.C.

RAILROAD BRIDGE — Above: Drilling 30' holes in concrete piers of old railroad bridge, job that calls for Condor heavy duck ply air hose on manifold feeds, and lighter, highly flexible Homo-Flex Hose on drills.

On jobs like those pictured here, profit depends on pushing up the schedules. You can't afford hose failures when men and machinery must wait for replacements. Condor hose constructions are engineered for the heavy demands of big projects. Each hose is built for a specific service . . . You can rely on Manhattan's 54 years of engineering experience for hose that keeps you ahead of schedule.

Bulletin 8688 shows many other case history photos of Manhattan hose, conveyor belts, transmission belts and V-belts in action on history-making construction jobs. Your copy will be sent with no obligation.

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MANHATTAN RUBBER DIVISION PASSAIC, NEW JERSEY

stitute and Harvard, and prior to joining the Division of Purchase and Contract was with the N. C. Highway Commission.

Oscar E. Hewitt, Chicago Commissioner of Public Works, on June 15 received an honorary degree of doctor of laws at the 118th annual commencement of Illionis College, Jacksonville, Ill., from which he was graduated in 1900.

D. Carothers, on June 1 became assistant chief engineer of the Gulf Mobile & Ohio R. R., with offices in Bloomington, Ill., following merger of The Alton Road into the enlarged system. Formerly he was chief engineer of the Alton.

John D. Adams has recently been appointed engineer and road superintendent for Carleton County, Ont. Graduated as a civil engineer in 1933, Mr. Adams has spent considerable time working on highway and irrigation projects in western Canada and was with the Ontario Department of Highways prior to the war. He spent the war years in doing engineering work with Brunner Mond and Ford Motor Co. as well as acting as plant engineer for the Central Aircraft Manufacturing Co. After the war, Mr. Adams resumed civil engineering practice in London, Ont.

George Edward Treloar, 54, civil engineer, has been elected president of the Canadian Institute of Steel Construction. He is chief engineer of the Sarnia Bridge Co., and president and manager of T. Tomlinson Foundry Co. He was graduated from the University of Toronto in 1914 and received his master's degree in 1915. His career includes 10 years of estimating and designing with the Dominion Bridge Co., followed by 8 years in private practice.

W. O. Jones, acting city manager of Ft. Worth, Tex., for the last year, has been appointed city manager. He was given an indefinite leave of absence form his job as director of public works. He is a graduate of Texas A & M College and has worked for the city for 27 years.

E. F. Barratt has been appointed city engineer for North Bay, Ont. He was formerly engineer and road superintendent for the county of Wentworth.

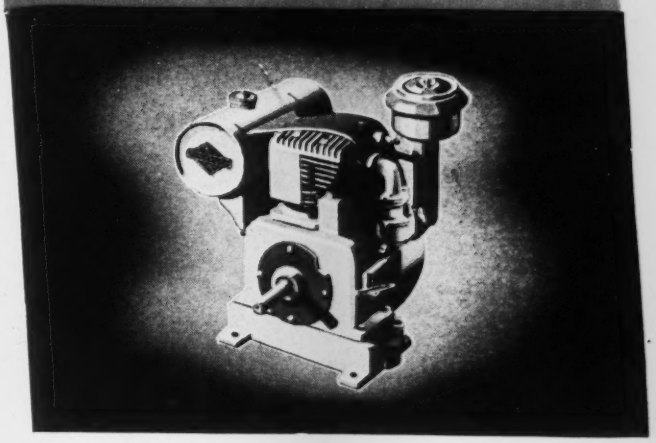
William E. Hatch, of Hyannis, Mass., a civil engineer in private practice and a member of the Cape Cod Society of Professional Engineers and Land Surveyors, has been appointed instructor in surveying at the University of Illinois summer camp at Blackduck, Minn.

Richard A. Holderman, of Lockport,

THREE MILLION

BRIGGS & STRATTON ENGINES

A NEW PEAK IN GASOLINE POWER HISTORY



When the 3 MILLIONTH Briggs & Stratton engine came off our production lines recently, a series of new records was established for the entire industry. It is by far the greatest number of 4-cycle air-cooled engines ever built by one manufacturer. It is by far the longest period . . . more than 27 years . . . that any manufacturer has built 4-cycle air-cooled engines *continuously, without interruption.* Back of these engines Briggs & Stratton maintains the most extensive, worldwide network of *Authorized Service Stations* in the small engine field.

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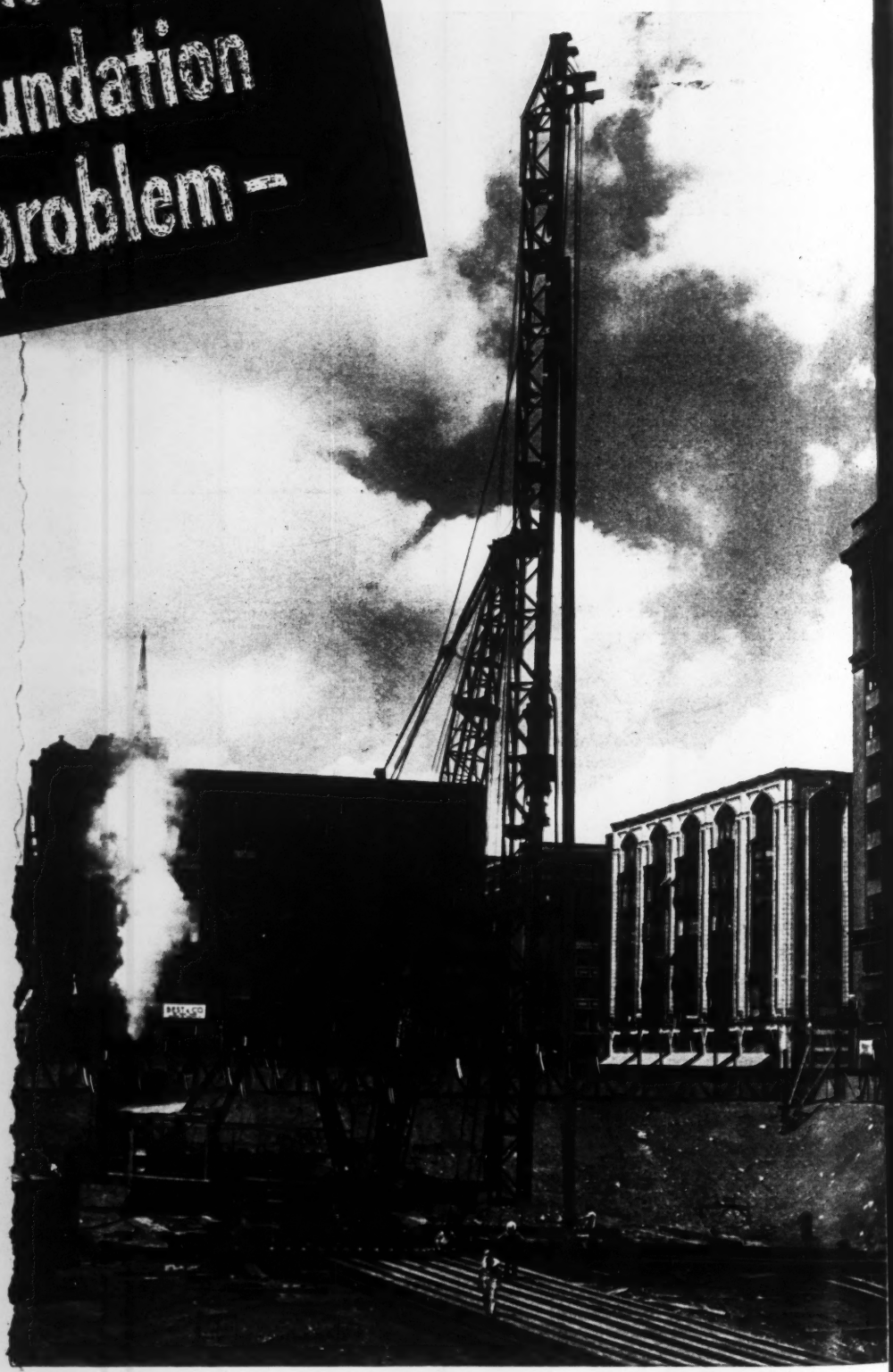


Interesting construction details

Type of Building:
26-story office building.

• • •

Base Area:
62,500 square feet.
(250 x 250 feet)

• • •

Number of Bearing Piles Used: 1567

• • •

Length of Piles:
88 feet to 120 feet, shorter lengths spliced by welding.

• • •

Driving Depth:
128 feet to 160 feet from street level through gravel and sand fill, silt, clay, hard-pan to bedrock.

• • •

Total Load on Piles:
Approximately 140,000 tons.

• • •

Load Per Pile:
89.3 tons, approximately.

• • •

Allowable Load Per Pile:
90 tons, by Boston Building Department.

• • •

Piles Used:
14-inch, 117-lb H-Beam Bearing Piles.

N. Y., who was graduated from Rensselaer Polytechnic Institute in 1938 with a degree in civil engineering, and who received his master's degree in structural engineering at Yale in 1941, has been added to the engineering staff of J. R. Reynolds Tobacco Co., at Winston-Salem, N. C., after having been connected with United Engineers and Constructors, Inc., of Philadelphia, Pa. He served in the Army Air Forces as a Flight engineer during the war.

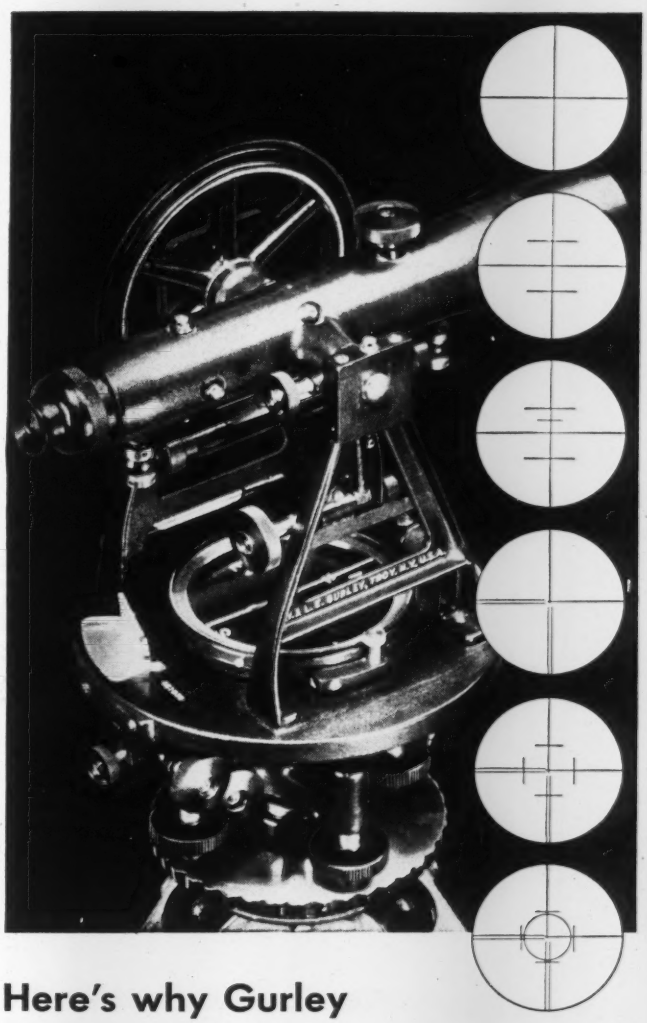
Francis Euclide has been appointed acting city engineer of Green Bay, Wis.

R. W. Alexander, of Westboro, Ont., has been named engineer of Nepean Township, Ont.

Roy L. Williamson, who resigned recently as city manager at Burlington, N. C., has been named city manager of Rocky Mount, N. C., succeeding **L. B. Aycock.** Williamson received his civil engineering degree from North Carolina State College in 1917, and worked as an engineer with the Southern Railway until 1918 when he went overseas as a second lieutenant with the Army Engineers Corps in World War I. He served with the North Carolina Highway Commission from 1919 until 1925 when he began working with the city of Raleigh, N. C., as a municipal engineer, later becoming assistant director of utilities and commissioner of public works. In 1944 he resigned to become property officer and executive secretary of several foundations at N. C. State College and moved to Burlington as city manager in June, 1945. Mr. Aycock has held the dual post of city manager and city auditor for the last 18 years and has asked that he be relieved of his duties as city manager. He will continue as city auditor.

Roger T. Chandler has been appointed assistant traffic engineer of Providence, R. I., under traffic engineer Philip S. Mancini. He is an engineering graduate of Yale University, has recently completed a year's course at the Yale Bureau of Highway Traffic, and after the close of the war he was assistant public works officer at the Naval Air Technical Training Center, Jacksonville, Fla. Lately he has been connected with the Maryland Park and Planning Commission.

C. R. Baxter has opened an office for land and lot surveys and subdivision designs, at 410½ East Adams St., Springfield, Ill., to be called C. R. Baxter and Associates. Working with him are: Walter Bliefnick and Charles McGuire. From 1936 to 1940, Baxter was Adams County superintendent of highways, Quincy, Ill.; from 1940 to



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B. Cross-lines and stadia lines, spaced 1:100.

E. & F. Quarter-interval stadia lines in upper or lower field, added to "B" for stadia readings of 1:400. For Alidades.

O. Parallel horizontal and vertical lines combined with regular cross-lines.

T. Stadia lines spaced 1:100 horizontally and vertically, added to "O".

S. Solar reticle. A combination of "O" and "T" with a circle 15′ 45″ radius for centering the sun's image.

Here's why Gurley Instruments now feature quick-reading glass reticles...exclusively

Study these new reticle patterns. Think of them in the telescope of your new Gurley transit. They'll make your next surveying assignment much easier.

Here's the latest advance in engineering instrument design—*glass reticles* to suit all surveying requirements and climatic conditions, developed by Gurley for added efficiency and accuracy.

Short stadia lines, spaced and ruled at precise intervals, are quickly identified since they do not extend over the entire field of view, as in continuous filament reticles. There is no chance of confusion with the regular cross-lines, nor can they be affected by moisture.

Several reticle pattern designs are available in Gurley instruments, from parallel horizontal and vertical lines, combined with cross-lines for triangulation and stellar observations, to solar reticles for centering the sun's image. Besides those illustrated Gurley can provide other patterns and vary the weight of reticle lines to suit your requirements. Gurley's knowledge of optics, lens grinding and specially developed reticle-making equipment assure all-important uniformity of line.

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that is more than skin deep

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on the construction job, particularly, a good gas welding and flame cutting outfit is a necessity. on a construction job, however, such an outfit is used largely for emergency repair, for hard facing, for silver brazing and for flame cutting—such an outfit, therefore, must be dependable . . . on the job when needed. and—that quality is one of the numerous reasons why victor welding and cutting equipment is today the most popular and one of the most highly regarded in industry.

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san francisco **los angeles**

victor distributors from coast to coast Ad 190

1942, he was city engineer, Quincy. After being city engineer of Quincy, he joined the Bureau of Yards and Docks, U. S. Navy, serving as chief field engineer at the Quincy yards. Since 1944, he has been doing free-lance engineering work in Springfield. He received his technical training at the University of Kansas and advanced work at the University of Illinois.

Paul Weir, assistant general manager of the Atlanta, Ga., waterworks, has been appointed manager to fill the unexpired term of **W. Zode Smith,** who is retiring after 57 years in the service of the city, 37 of them as head of the water department. Mr. Weir, whose appointment runs until Jan. 1, 1949, has been with the department for 19 years, serving as chemical laboratory technician superintendent of filtration, and assistant general manager. He is a graduate of Georgia Tech, where he specialized in hydraulics and sanitary engineering. He is president of the Georgia Engineering Society. He was winner of the Fuller Award for outstanding engineering leadership in the Southeastern states in 1940, and the International Goodell prize for research in corrosion control and protective pipe linings in 1941.

J. V. Waddell, former Fayette county highway superintendent, Vandalia, Ill., has been appointed assistant to E. L. Gilkeson, Fayette County highway superintendent, on a township roads program.

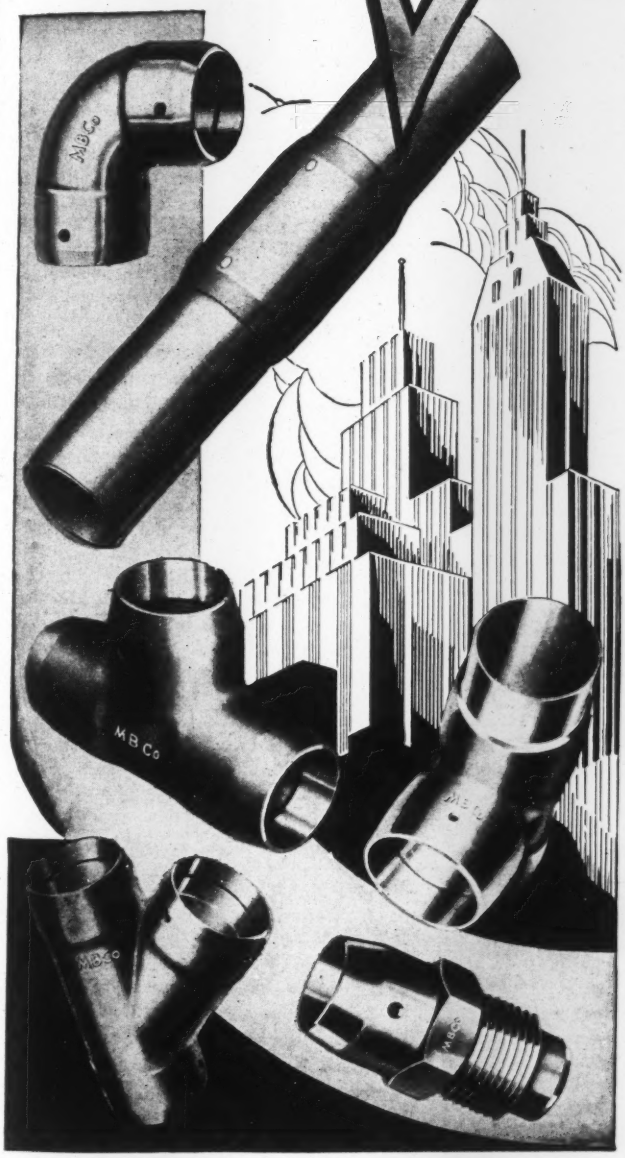
Henry H. Morgan, Indianapolis, Ind., civil engineer, has been named a member of the City Planning Commission there, succeeding the late John W. Atherton. Mr. Morgan was a staff member of the commission, serving as assistant director of city planning, from 1944 to 1946. Before that he was in charge of operations in southeastern states for Michael Baker, Jr., Pittsburgh, Pa., consulting engineer and planner; an engineer for the Indiana State Highway Commission, and also was engaged in state park planning and redevelopment work. He is chairman of the American Public Works Association national planning committee.

Gov. Ralph F. Gates, of Indiana, has appointed **James D. Harrison,** Indianapolis, director of the Indiana Traffic Safety Commission, created by the 1947 legislature, and has appointed **J. L. Lingo,** director of the Purdue Public

WHEN YOUR PLANS CALL FOR PIPE AND FITTINGS Check

·STREAMLINE·

AD[illegible]ARK REG. U. S. PAT. OFFICE



STREAMLINE Copper Pipe connected with STREAMLINE Fittings are the ideal materials for water service lines or for all general plumbing and heating about the plant buildings. They have many applications in filtration plants; in aeration lines, and in heating coils using the sludge digestion system in sewage disposal plants.

A service line of STREAMLINE Copper connected with STREAMLINE Fittings cannot rust and is vibration proof. The effects of vibration are harmlessly dissipated throughout the installation and are not localized at the joints as is often the case with service piping that requires threaded fittings. Settlement of filled earth or of water mains, etc., does not affect it. Copper Pipe is ductile and does not easily break off.

Rustable piping, which has been in service for a number of years, may outwardly still appear to be in fair condition, but it is almost a certainty that the walls of the pipe, in many places, have been so reduced by corrosion, that it is only a matter of time until failure occurs. More than that, the internal capacity of the pipe has, in the great majority of cases, been greatly reduced by the accumulation of slime and rust.

An installation of STREAMLINE Copper Pipe and Fittings insures a lifetime, trouble-free piping system, that with the possible exception of abnormal earth or water conditions, need never again be replaced for many generations to come—if ever.

When your plans call for pipe and fittings for replacement or for postwar work, carefully consider STREAMLINE. Its use will repay you many times over.

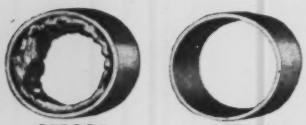
STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN

36,960,000 FEET OF PIPE

CLEANED BY NATIONAL

Each mile of pipe traversed has added to our specialized knowledge, improved our equipment and developed our organization. Without this long background of experience, we could not today clean so quickly, so surely and so economically.

National "Know-How" Pays



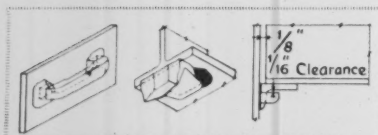
BEFORE AFTER

The quicker and better we clean, the less your services are interrupted, the less supplementary labor you supply and the more sure you are of satisfaction. We guarantee to restore any pipe to within at least 95% of its original capacity.

NATIONAL WATER MAIN CLEANING COMPANY

50 CHURCH STREET, NEW YORK 7, N. Y.

ATLANTA..1221 Mortgage Guarantee Building
BOSTON.....115 Peterboro Street
CHICAGO.....205 West Wacker Drive
HOUSTON.....2518 Grant Street
KANSAS CITY.....421 B.M.A. Building
LOS ANGELES.....448 South Hilll Street
MEMPHIS.....822 Dermon B.ilding
OMAHA.....3812 Castellar Street
RICHMOND.....210 East Franklin Street
ST. LOUIS.....7103 Dale Avenue
SALT LAKE CITY.149-151 W. Second South St.
SAN FRANCISCO.....681 Market Street
MONTREAL.....2028 Union Avenue
WACO.....P. O. Box 887
WINNIPEG.....576 Wall Street
Havana - Mayaguez, Puerto Rico - Bogota - Caracas - Mexico City



WELDING CONNECTORS

Saxe System Welded Connection Units for welded assembly

Saxe Units place in position and securely hold together structural parts to be welded.

As used in many welded structures they *eliminate all hole punching*, producing an economical, rigid, safe and quickly erected structural frame.

Write for descriptive literature

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Buffalo-7, New York
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DREDGES

HYDRAULIC
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Bolted sectional steel hulls for landlocked, inland waters

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AMERICAN STEEL DREDGE CO. INC.
FORT WAYNE 1 · INDIANA · U.S.A.

DESIGNERS AND BUILDERS OF DREDGING EQUIPMENT SINCE 1905

Safety Institute, as a consultant to the commission.

C. C. White, district highway superintendent at Pine Bluff, Ark., has become state maintenance engineer, succeeding R. B. Winfrey, resigned. H. M. McMurray will succeed White at Pine Bluff.

Gerald Cooper, 45, assistant engineer for Linn County, Kan., for the last six years, has been engaged as county engineer for Bourbon County. He succeeds **Grover C. Thompson,** who resigned May 24 and left Fort Scott to be an engineer on the Kortes Dam project near Casper, Wyo.

Alexander Matiuk, formerly power plant project engineer for Ebasco Services, Inc., of New York City, has joined Douglas M. McBean, consulting engineer, of Rochester, N. Y., as power engineer for the design and engineering of steam, electric and boiler plants.

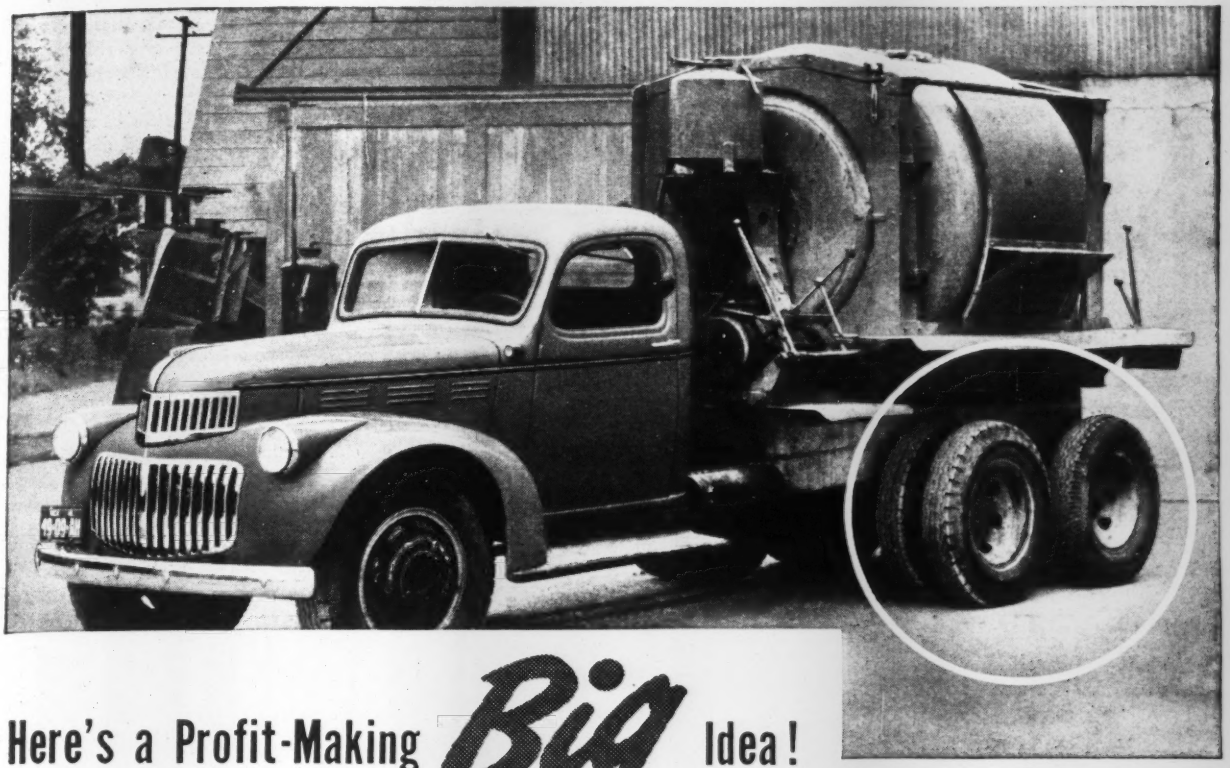
A. P. Hancock, city manager of Amarillo, Tex., has resigned to become secretary-treasurer of a power transmission equipment firm in that city. He has been city manager since 1941. He was city manager of Crystal City and Kerrville before taking the Amarillo post. He is a civil engineer and a graduate of Texas A & M College.

E. L. Hotron, Jr., 27-year-old veteran has assumed his duties as city engineer for Abilene, Tex. He succeeded Earnest Yeatts, resigned.

Col. Charles E. Walsh, Jr., of Albany, N. Y., has become assistant superintendent of operation and maintenance of the New York State Department of Public Works. He succeeds **John A. MacCormack,** who becomes state commissioner of standards and purchase. Colonel Walsh will have charge of state-owned properties operated and maintained by the Department of Public Works. During the war he saw active service in the Pacific Theater and was promoted to colonel. While stationed at Fort Benning he was officer in charge of buildings, maintenance and properties.

Victor Whiteside, of Kansas City, Mo., has been employed by the city commission of Iola, Kan., as city engineer. He will supervise utilities, streets, parks, the municipal airport, and other city properties.

Col. S. C. MacIntire, for the last several months deputy regional director officer of real property disposal in Charlotte, has been named industrial en-



Here's a Profit-Making *Big* Idea!

You can convert your 4-wheel medium-duty trucks into 6-wheel, heavy-duty haulers simply by installing Thornton 4-rear-wheel Drives!

Trucks with a normal G.V.W. of 15,000 to 16,000 lbs. increase their G.V.W. rating to 26,000 to 32,000 lbs. as trucks—42,000 to 44,000 lbs. as tractors. You can carry more heavy materials and equipment for road construction and repair work, can increase general hauling loads.

A NoSPIN Differential is included in the two-speed gear case assembly on Thornton 4-rear-wheel Drive. This famous automatic-locking differential makes possible positive drive at all times. It can also be installed in each driving axle to prevent wheel-spin.

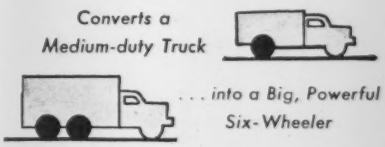
As a result, performance of your trucks is improved in mud, sand, snow, hills, mountain grades. And better flotation is assured because the load is spread over eight rear tires instead of four.

Thornton 4-rear-wheel Drive includes two extra dual wheels, four extra tires, heavy-duty "walking-beam" springs, necessary frame reinforcements and attaching parts. *Provides heavy-duty hauling without heavy-duty cost.*

For details see your truck dealer or local Truckstell distributor. Or send coupon below. The Truckstell Company, Union Commerce Bldg., Cleveland 14, Ohio.

THORNTON 4-REAR-WHEEL DRIVE

Converts a Medium-duty Truck

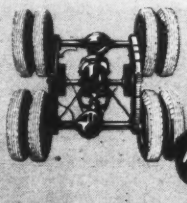


. . . into a Big, Powerful Six-Wheeler

RESULT: 100% More Payload
100% More Tractive Effort

THE NoSPIN DIFFERENTIAL used in the Thornton 4-rear-wheel Drive will also increase the efficiency of *4-wheel* trucks. Fits virtually any driving axle. Prevents wheel-spin . . . keeps trucks from stalling in mud, muck, sand, snow . . . on ice or on slippery roads.

FREE! Send for your free copy of new illustrated folder. Tells how the Thornton 4-rear-wheel Drive will help you solve your problems.



THORNTON 4-REAR-WHEEL DRIVE

Approved and Distributed by TRUCKSTELL
SPECIALIZED EQUIPMENT FOR PLUS PERFORMANCE

***Mfd. by* DETROIT AUTOMOTIVE PRODUCTS CORP.**
(Formerly Thornton Tandem Company) DETROIT, MICH.

The Truckstell Company, Dept. EN-7
1274 Union Commerce Bldg., Cleveland 14, Ohio

Yes . . . I want to know *more* about the Thornton 4-rear-wheel Drive, and how it will enable my ..... (make) trucks to earn more money. Please send free folder and name of nearest Truckstell distributor.

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City ..... Zone ..... State .....

Sherlock Holmes seldom made mistakes. Maybe you don't, either, but it's good to know that when you *want* to erase, you *can* on PEL-X Water Repellent Tracing Cloth — without detection!

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WITH A CAPITAL "E" FOR EXCELLENCE

FOR BETTER PLANS . . . Better Plan on PEL-X Tracing Cloth

WHITE PENCIL PEL-X WATER REPELLENT TRACING CLOTH

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ERIE *Standard* 2-LINE REHANDLER

THIS compact Lever Arm Rehandler Bucket of normal proportions has ample closing power to fill to capacity in compact materials, and is so designed that the reeving can be adjusted to obtain maximum speed with capacity grabs in loose materials. We have reduced the "height open dimension" thus requiring minimum headroom, enabling you to pile higher and to discharge into higher hoppers. Lighter weight alloy construction provides more pay load (scoop contents) less bucket dead weight. To see this bucket in all detail write for bulletin 403.

● *Write for Booklet 403*

ERIE BUCKETS • *A Complete Line*

Erie Steel Construction Co., 166 Geist Rd., Erie, Pa.

BUCKETS • AGGREMETERS • PORTABLE CONCRETE PLANTS

gineer for Monroe, N. C. Colonel MacIntire received his engineering degree at the University of Pennsylvania and later did graduate work at the Wisconsin and Iowa. He has served more than 25 years in the Army and is a veteran of both wars.

A. Lanfair has resigned from the Illinois Department of Aeronautics, where he was civil engineer, to accept a position in Arabia.

Ben Woods has left his position as junior engineer, Illinois Department of Aeronautics, to go into private business in Mt. Auburn, Ill.

Robert L. Faith, formerly junior engineer, Illinois Department of Aeronautics, is now with the A. E. Staley Manufacturing Co., Decatur, Ill., as a civil engineer.

W. R. Cooke has begun with the Illinois Department of Aeronautics, Springfield, as junior engineer.

Frank L. Nicholson, chief engineer, Norfolk & Southern Railway since 1909, has retired after 57 years of service with company.

M. C. Jennett has been appointed engineer of maintenance of way, with jurisdiction over the tracks and structures of the Norfolk & Southern Railway.

Kenneth M. Adelstein is assistant regional chairman of the committee of awards, War Assets Administration at Richmond, Va.

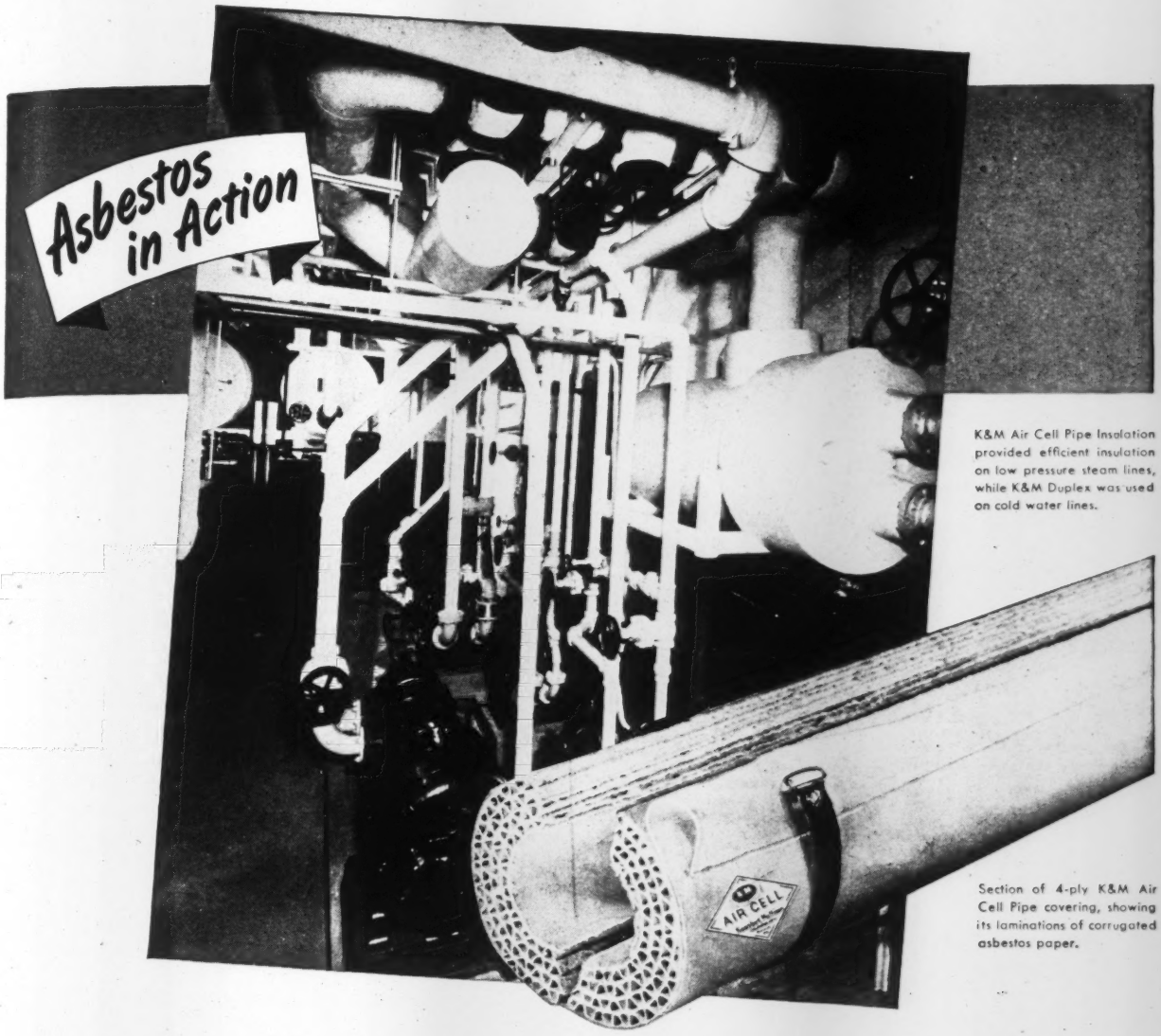
Lloyd F. Petticrew, for 22 years on the staff of the superintendent of highways, Champaign County, Ill., has resigned as highway engineer.

E. B. Crane, formerly principal assistant engineer at Seattle, Wash., has been appointed chief engineer for the Milwaukee Road's western lines, with headquarters in Seattle.

Charles C. Bayles, housing expeditor at Eugene, Ore., has resigned to open an office as consulting engineer in Eugene. He served as a major in the Corps of Engineers during the war.

E. P. Koonce, resident engineer in division 4 for the North Carolina State Highway & Public Works Commission, has been promoted to senior construction engineer for divisions 1-2-3-4.

Leroy M. Satrom, recently graduated from the Case Institute of Technology, has been appointed Portage County, Ohio, deputy engineer at Ravenna.



K&M Air Cell Pipe Insulation provided efficient insulation on low pressure steam lines, while K&M Duplex was used on cold water lines.

Section of 4-ply K&M Air Cell Pipe covering, showing its laminations of corrugated asbestos paper.

For efficient low pressure insulation

K&M AIR CELL PIPE INSULATION

Nature made Asbestos
Keasbey & Mattison has made it serve mankind since 1873.

The engineer for this Texas commercial building made a wise choice when he specified K&M Air Cell Pipe covering for the steam lines. He got an asbestos insulating material of exceptional efficiency on lines carrying up to 300°. He also got an economical installation . . . for K&M Air Cell's extreme light weight and split construction makes for easier application.

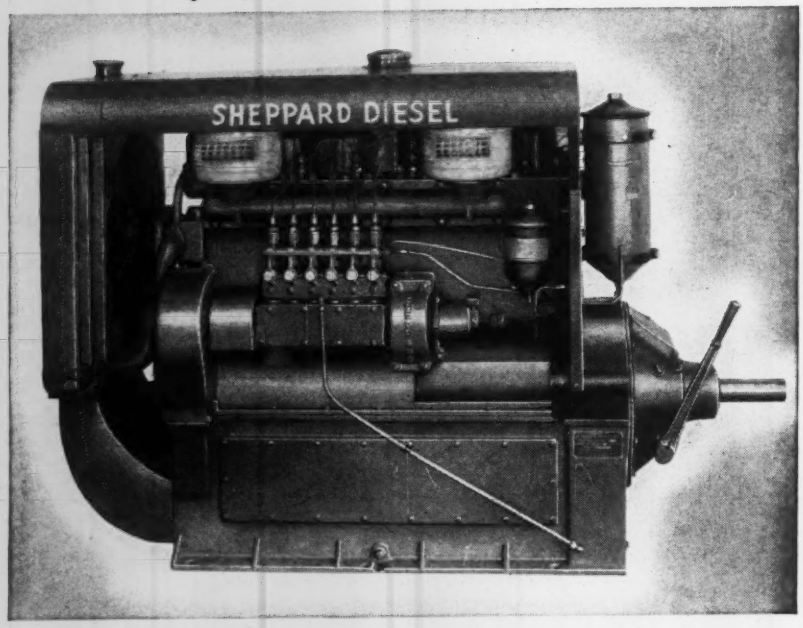
As a finish over the block insulation on the boilers, he chose K&M Asbestos Insulating Cement. This cement combines maximum insulating efficiency with maximum covering capacity.

If you have a low pressure insulation problem, why not let our engineers tackle the job for you? Their training and experience are backed by a complete line of K&M insulating materials for every industrial need. And K&M has expert application contractors, located strategically throughout the country, to assure you of a high quality job. Write us—we'll attend to your inquiries promptly.

K&M best in asbestos
Reg. U. S. Pat. Off.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

MORE *Actual* POWER



MEANS *Less* POWER COSTS

This 6 cylinder Sheppard Diesel . . . rated at 56 continuous H.P. at 1200 R.P.M. or 62 continuous H.P. at 1400 R.P.M. . . . will do the work of most 100 H.P. engines at a fuel cost of approximately 31c per hour when operating under full load.*

Why?

Because Sheppard Diesels are rated by their actual *continuous* power output when operating with *all accessories.* This is in sharp contrast with most engine ratings which are based on the *calculated* performance of a *bare* engine.

Delivered complete with electric push-button starting, Sheppard Diesels are simple to operate, easy to service. Their *full diesel* operation reduces power costs still further by eliminating the maintenance of an electrical ignition system and a carburetor.

Write today for literature and specifications on the model 12 Sheppard . . . the Diesel that delivers *all* the power you buy!

R. H. SHEPPARD CO., INC., 10 Middle St., Hanover, Pa.

Generating Sets, 2,000 to 36,000 watts • Power Units, 3½ to 62 continuous H.P.

Sheppard DIESEL

DIESEL'S THE POWER . . .

Sheppards' the Diesel

*Using 8½c gal. fuel oil.

Elections and Activities

The Washington, D. C., Building Congress has elected John G. Scharf president. He is president of the Prescott Construction Co. Other officers: Louis J. Justement, architect, P. Y. K. Howat, Howat Concrete Co., and William F. Nelson, brick contractor, vice-presidents; and George V. Graham, A. P. Woodson Co., secretary. W. A. H. Church of the Galliher Lumber Co., was reelected treasurer. Directors to 1950 are: William K. Karsunky, consulting engineer; M. C. MacKinnon, Super Concrete Corp., and Thomas H. Locraft, architect, Murphy & Locraft.

George Edward Treloar, chief engineer of Sarnia Bridge Co., and a graduate civil engineer from the University of Toronto, has been elected president of the Canadian Institute of Steel Construction.

The Engineers Club of Baltimore, Md., elected the following officers at its annual meeting recently: Nathan L. Smith, president; Lucius R. White, Jr., first vice-president; Robert H. Roy, second vice-president, and L. P. Kimball, treasurer.

Directors at large are: M. C. Albrittain, G. H. Dayett. Emil Gathmann, Jr., Arthur Van Reuth, A. Russell Vollmer and Wm. A. Weech. Wm. B. Spencer and R. L. Thmas are trustees of the permanent fund.

A branch of the Military Engineers' Association of Canada, has been organized for the province of New Brunswick. The start was made with 45 members, and former engineering officers who are now engaged in civilian engineering may join as associate members. Quarterly meetings are to be held at the Armory, St. John, N. B. The first slate of officers; Chairman, Lieut. Col. G. Lilley; secretary-treasurer, Capt. F. E. Barr, both of the Royal Canadian Engineers, at St. John.

Stewart Voden, Great Falls, Mont., was elected president of the Montana section of the American Water Works Association at the 22nd annual convention held recently at Havre. Other officers are: John Haezen, Butte, vice-chairman; C. W. Brinck, Helena, secretary-treasurer; M. F. Dixon, Billings, and W. R. Border, trustees; and J. R. Cortese, Livingston, director.

Carl David, Butte, Mont., engineer, was elected president of the Montana Society of Engineers at the organiza-

Countrywide Acceptance in Less than Two Years

Want to get better fragmentation of your rock? Increase production as much as 30%? Reduce "back break"? Cut down complaints about noise and vibration, even though you fire more holes? Put Atlas Rockmaster to work!

All over the country blasters are getting results like these with the Atlas Rockmaster Blasting System—in quarries, strip pits, on construction work, even underground in many cases! Wherever this sensational development has proved applicable, *greater efficiency* has always followed—sometimes in one way, frequently in all four.

Pioneered and originated by Atlas, Rockmaster is a whole new system of blasting that controls the delay elements of a shot within thousandths of a second—split-timing such as has never before been possible. The system was introduced in 1945. More than 2,000,000 special Rockmaster electric blasting devices were sold in 1946 alone! And two years of experience with split-second delay blasting have given Atlas blasting technicians a background of know-how that cannot be gained in any other way.

Today there are many imitations of this amazing blasting system, but only one *original* Rockmaster that has proved itself with spectacular results—the kind of results *you* want. Call in the Atlas representative and talk over your problem. He'll be glad to show you how Rockmaster can help.

FAMOUS FOR 4 OUTSTANDING RESULTS

1. **MORE ROCK READY FOR SHOVEL**
2. **BETTER FRAGMENTATION**—Less secondary blasting. Shovel efficiency increased as much as 30%
3. **FAR LESS "BACK BREAK"** behind your shots
4. **MINIMUM NOISE AND VIBRATION,** even though more holes are fired.

Less Bark . . . More Bite

"ROCKMASTER"—Trade Mark

ATLAS EXPLOSIVES

"Everything for Blasting"

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

HOLYOKE FILTERS

HOLYOKE MACHINE COMPANY

Now Offers

COMPLETE

"HOLYOKE" GRAVITY AND PRESSURE

FILTERS

For Municipalities, Swimming Pools
Paper, Textile and Other Industries

REPAIR PARTS AND SERVICE

Available to owners of Leading Types Of Filters

Phone, write or wire us for recommendations on your next—

FILTER INSTALLATION

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HOLYOKE MACHINE COMPANY
HOLYOKE, MASS.

Diamond Core *Drilling*

CORE BORINGS
for Foundations, Dams, Bridges and all Heavy Structures
GROUT HOLES

Tinney Drilling Co.
Grafton, W. Va.

tion's 60th anniversary meeting held recently at Butte. Mr. Davis succeeded C. H. Steele, also of Butte. Others elected are A. J. M. Johnson, Bozeman, first vice-president; C. A. Champ, Butte, second vice-president; and R. D. Piper, Butte, secretary and treasurer. Named to the board of trustees for three years are F. C. Gilbert; and August Grunert, Butte. M. Wade Plummber, Butte, one year.

Edward S. McLarty, Sr., Culver City, Calif., was elected president of the Southern Section, National Association of Sanitarians at a Los Angeles meeting. Leland Sumner, Bakersfield, was elected vice-president; H. F. Parrish, Los Angeles, treasurer; Ross Grey, Long Beach, W. A. McCreery, Los Angeles county, and Joseph Sollins, Los Angeles, directors.

The newly organized Kansas Section of the American Water Works Association and the Kansas Sewage Association recently held a joint annual session at Wichita. The Kansas Section of A.W.W.A. has grown in a short time from 22 to 100 members. The Kansas Water Works men withdrew from the Missouri Valley Association over a year ago. New leaders elected by A. W. W. A. were E. J. Aallison, city manager of Salina, chairman; H. H. Kansteiner, superintendent of production and distribution of Leavenworth, vice-chairman; and Major Hagar, water superintendent of Lawrence, secretary-treasurer. Past president Frank E. Willey, of Topeka will continue as a trustee, and Prof. F. A. Russell, of Lawrence, has two years remaining as trustee. Officers for the Kansas Sewage Works Association during the next year will be Neal F. Harr, city engineer of McPherson, chairman; R. M. Lindsey, superintendent of gas plant of Humboldt, vice-chairman; and Ben L. Williamson, chief engineer, division of sanitation, State Board of Health, secretary-treasurer. Past president of the association is Murray Wilson, Wilson & Co. engineers at Salina, Kan.

The Georgia Association of Registered Land Surveyors was organized recently by 35 surveyors representing all sections of the State at a meeting at Georgia Tech.

Objective of the Association, as set out in a constitution adopted at the meeting, is to "advance the public welfare" and promote ethical standards among land surveyors.

C. E. Layton, Thomasville City Manager, was elected president.

Other officers are: K. M. Thrash, of Georgia Tech, First vice-president; J. F. Carey, of Atlanta, Second vice-presi-

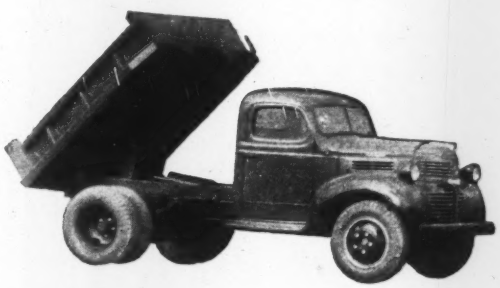
Uncover larger earthmoving Profits

. . . roll back the dirt quickly with Heil Hydraulic Bulldozers

The dirt really rolls back when you use a Heil Hydraulic Bulldozer. Yardages are bigger — costs lower. The secret of this unequalled rolling action lies in the design of the Heil Bulldozer blade. The scientific contour of this blade, developed after many years of earthmoving experience, provides a cleaner cutting action and a bigger load-carrying capacity without increasing size or weight. The cutting edges, made of special wear-resistant steel, are reversible. The additional life gained is just another of many Heil cost-cutting features. Here are a few more that save you time and money on any job:

The easy-handling, trouble-free Heil hydraulic unit provides quick finger-tip control. The positive action enables the operator to place the blade exactly where he wants it — he can dig faster and move more dirt. The all-welded, box-section construction, the sturdy connections, and the proper distribution of loads and stresses keep your tractors on the job longer — making bigger profits for you. Install a Heil Hydraulic Bulldozer on your Oliver-Cletrac as soon as possible. It's an easy, quick mounting job. See your Oliver-Cletrac distributor.

Heil Dump Bodies and Hoists are built to take the punishment of tough working schedules—there is less time out, less expense for repairs, and you haul more loads per day, when these long-life units are on the job. Your local Heil distributor has all the facts about why it pays to use Heil Twin-Arm Hoists and Bodies.



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FORMULA No. 640

a clear liquid waterproofing for old or new construction

PENETRATES

deeply—one inch or more—is not a surface treatment. Brush, spray, or float on stone, cast stone, concrete, mortar, stucco, tile, brick, plaster, wood, wall board — any absorbent material.

WATERPROOFS,

preserves, prevents dusting of floors, surface dirt washes away in rain.

FORMULA NO. 640

is a balanced formula of seven different waxes and resins in a hydrocarbon solvent.

ACID-ALKALI proof

does not oxidize, unchanged by temperature.

PERMANENCE

it is our opinion it will last as long as the concrete, mortar, stucco, etc. lasts.

OIL PAINT

saponifies on cement unless sealed first with Formula No. 640.

APPLY to either side:

The pressure side, or opposite side —it is equally effective.

HYDROSTATIC PRESSURE

a 20 foot head has been held by Formula No. 640.

CUTS WATERPROOFING COSTS

because it applies three times as fast as paint, requires no special technique.
No preparation — comes ready to apply.
Eliminates necessity of furring.
Concrete floors and walls need no membraning.

Keeps in all climates
Harmless to use
Good coverage
Moderate price

Write our Engineering Department for office test kit, technical data, or regarding any special problem.

J. Wilbur Haynes, Engineer

OTHER PRODUCTS: Formula No. 640 Toxic, combines waterproofing with termite and fungus protection; cement hardener; floor mastic; roof coatings, etc.

HAYNES PRODUCTS CO.
4007 Farnam St.
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dent; G. V. Carr, of Columbus, secretary; C. R. Roberts, of Atlanta, treasurer; R. P. Black, of Georgia Tech, National Representative and Charles M. Thomas, of Atlanta, alternate.

Directors are: P. W. Schinkel, of Cairo: L. R. Aldridge, of Columbus; T. Y. Maddox, of Newman; E. Z. Huff, of Atlanta, Horace McSwain, of Macon; J. B. Lovell of Rome; A. J. Kirby, of Cordele; C. C. Hawkin of Winterville; M. W. Hall, of Augusta, and R. E. King, of Savannah.

Brig. Gen. Lewis A. Pick, Missouri River division chief of the Army Corps of Engineers, has been re-elected chairman of the Missouri basin inter-agency committee. He will serve his second year as chairman of the federal and state officials who comprise a committee to co-ordinate planning, construction and administration of a multiple-purpose development program authorized for the Missouri River by the federal flood control act of 1944. The general is co-author of the Pick-Sloan plan for development of Missouri River navigation, flood control, irrigation and hydroelectric power projects.

Members of the Construction Employers Association at Omaha, Neb., favor a 40-hour week in building construction. A. B. Parks, the secretary, said that the pressure for a 6-day week comes from the commercial jobs with owners anxious to have the work speeded up and ready to pay for overtime. Most who favor 6-day week are chiefly in the trades with insufficient workers. The organization elected temporary officials to serve until the annual meeting next February. They are: Wray M. Scott, president; S. C. Dodson, vice-president; Elliott Gilmore Second vice-president and Mr. Parks, secretary and treasurer.

Oscar P. Jordheim, Fargo, N. D., engineer with the George E. Haggart Construction Co. was named president of the Fargo Engineers club recently. Mr. Jordheim was formerly in the city engineer's office. Other officers elected are W. J. Promersberger, vice-president; W. H. Plath, re-elected secretary-treasurer; and Harry S. Dixon, director.

The city council of Albert Lea, Minn., recently created a municipal housing and development authority under the Municipal Housing and Development Act of the State of Minnesota, enacted by the 1947 legislature. This authority is composed of five men appointed by Mayor Ostrander with council approval. They are Reid Edwards, manufacturer, for 1-year term; Paul C. Belknap, publisher of the *Evening Tribune*, 2-year term; P. J. Lee, Interstate Power Co.,

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Superior Quality
BLADES
AND CUTTING EDGES

For any type or make of road building and maintenance equipment. Also—
BUCKET LIPS
WEARING BOOTS
BACK SLOPERS
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EXTENSNON BLADES, and
SCARIFIER TEETH
50 years experience and special steels forged at the edges assure that extra wearing quality you need. All widths lengths, and thicknesses; *punched ready to fit your machines.* Write for special Bulletins—give type and name of machines you operate.

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Yes sir, the improved ANHYDREX underground cables, now jacketed with neoprene, are designed to give you greater, more dependable performance than ever before — in both underground and open-air installations.

Their increased toughness assures longer life with less service interruptions, and establishes savings for you at the time you would otherwise be paying for expensive repairs and replacements.

But you needn't look even that far ahead, for savings from Simplex-ANHYDREX cables start with their installation. These cables can now be buried underground or run through open air **without ducts or conduit. Now you need only buy one cable for use in circuits partially below and partially above ground;** just one length of ANHYDREX will do the job — without splices.

When you're planning new systems for power transmission and distribution — or rewiring old ones — remember the economy of Simplex-ANHYDREX cables. Remember that they are the only underground cables featuring ANHYDREX insulation over the conductors and that no other rubber insulation today is as resistant to water and moisture. Remember the protection from acids and oils, flame, sunlight, and abrasives that the neoprene jacket provides and the trouble-free service it insures.

Yes, Simplex-ANHYDREX cables offer a wealth of advantages you won't want to forget. Why not write today for booklet 985-A? It will make remembering easy.

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Ingalls fabricated steel used in the new Ford assembly plant at Hapeville, Ga.

. . . and in this addition to General Motors' Harrison Radiator Division, Lockport, N. Y.

. . . and in the new Dayton, Ohio plant for Chrysler Corporation's Airtemp Division

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Ingalls fabricated steel is the framework for many of the nation's new and expanded manufacturing plants. Steel bearing the Ingalls label is thoroughly dependable. Formed to exact specifications, it requires a minimum of cutting or fitting on the job.

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THE INGALLS IRON WORKS CO., THE INGALLS SHIPBUILDING CORP., The Steel Construction Co., Birmingham Tank Co. Fabricating plants at Birmingham and Pittsburgh. Shipyards: Pascagoula, Miss., and Decatur, Ala. Offices: BIRMINGHAM, Pittsburgh, New York and New Orleans.

3-year term; William P. Stuttz, attorney, 4-year term; and John W. Baillie, president of American Gas Machine Co., 5-year term.

Although high costs and other factors have "stymied" the New York State highway program, arterial-development plans for Buffalo and Dunkirk have been completed and approved. Charles H. Sells, state superintendent of public works, disclosed in Buffalo in a report to the Conference of Mayors and the New York State Federation of Official Planning Boards.

The conference passed a resolution favoring state financial assistance for maintenance of highways and bridges on the state system within cities and villages.

Meeting in conjunction with the Mayors' Conference, the New York State Association of Municipal Engineers voted in favor of an amendment to the state highway law to require the state to bear the entire cost of land acquired in municipalities for highway use. Officers elected are: President, Charles E. Merritt, Utica; vice-president, Raymond W. Murphy, Rye; secretary-treasurer, James Sapanara, Utica.

T. A. Hunter was elected president of the recently organized Cedar Rapids Engineers Club, which has a membership of forty-eight representing a wide variety of engineering professions.

Other officers selected to serve during 1947-48 are: Vice-president, H. R. Mullinex of the Howard R. Green Company; Secretary, T. J. Redhouse, Iowa Steel & Iron Works; Treasurer, A. S. DeVries, Iowa Highway Commission, and members of the Board of Directors selected included: H. F. Allen, Link-Belt Speeder Corporation and L. R. Boettcher, a railroad man.

Rafael Pico, Chairman of the Puerto Rico Planning Urbanizing and Zoning Board was elected vice-president of the American Society of Planning Officials, at a recent convention held in Cincinnati, Ohio.

At the national convention of the American Society of Technical Appraisers, held in Chicago recently, Ambrose J. Winder, of Philadelphia, Pa., was re-elected national president, Vincent M. Reese, of Los Angeles, Calif., was elected national vice-president, Richard B. Hall, of Washington, D. C., was elected national secretary, Herbert Gnad of New York, was reelected national treasurer.

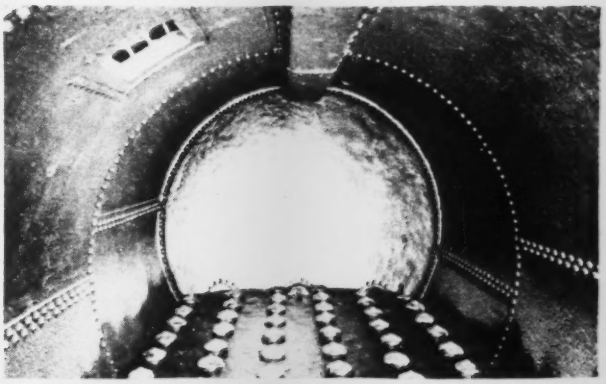
Thomas R. Jacobi, city engineer for Indianapolis, Ind., has been installed president of the Indiana Society of Professional Engineers. He succeeds

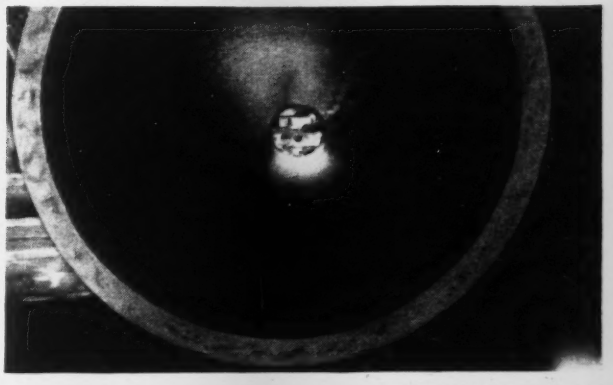
3 Vulnerable Spots in Waterworks...

where

NO-OX-ID

does a "swell" protecting job!





PRESSURE FILTERS

Applications of NO-OX-ID to the inside of pressure filters give lasting protection against corrosion. Attacks of water, oxygen, carbon dioxide, have no injurious effects on the dense, tough film. Chemical inhibitors prevent *underfilm* corrosion. The service life of pressure filters . . . even those with thick encrustations of rust . . . can be extended many years by "rejuvenating" NO-OX-ID coatings.

PIPE LININGS OR COATINGS

Specially compounded Waterworks NO-OX-ID No. 2 prevents both tuberculation and corrosion. Used as a coating or lining, the flexible nondrying film forms an intimate lasting bond with the metal. Has high dielectric strength. Imparts no taste or odor to water. Does not deteriorate by oxidation. NO-OX-ID can be applied at the mill, or on the job by regular plant personnel.

CONCRETE BASINS

Tough, chemically inhibited NO-OX-ID protects concrete as well as metal. Applied to concrete basins, it prevents costly leakage of water through joints and cracks. Stops cavitation due to weathering and chemical action. Coatings applied hot or cold over old or new concrete surfaces.

NO-OX-ID IRON-RUST

REG. TRADEMARK AUG. 27, 1918

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company
Dept. ER, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

For trouble-free, low cost measurement of—

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INDUSTRIAL WASTES
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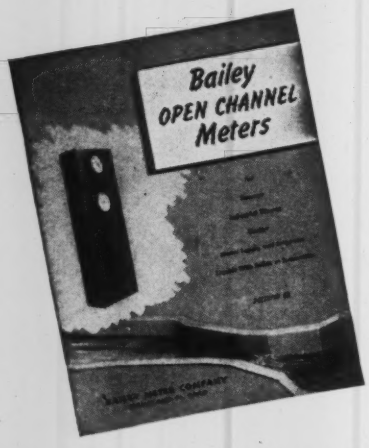
OPEN CHANNEL METERS
Offer These Advantages:



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2. Retain Accuracy
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4. Adjustable Capacities
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Steel Encasement and Fireproofing
Sewer, Water Pipe and Penstock Linings
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Carl E. Vogelgesang, Indianapolis, chief engineer for the Indiana State Highway Commission. Jacobi is a graduate of Purdue University and served as a lieutenant commander in the Navy's engineering corps during World War II. Prior to the war he was with Allen & Co., Lebanon, Ind., internationally known contracting firm. Other new officers of the Society are Col. Chester Litchenberg, Fort Wayne, first vice-president; F. B. Mendenhall, Indianapolis, second vice-president; Robert W. Hejder, Indianapolis, secretary; John Wilson, Indianapolis, executive secretary, and Fred L. Ashbaucher, Indianapolis.

Edward J. Nunan of the Erie County chapter, New York State Society of Professional Engineers, has been elected president of the Technical Societies' Council of the Niagara Frontier, which represents 23 engineering societies in the Buffalo area. Other officers are: Vice-president, Earl W. Fowler, American Society of Illuminating Engineers; secretary, Paul J. Pakurar, Niagara Frontier Society of Industrial Engineers, and treasurer, Carlos E. Harrington, ASME.

Earl C. Karker of the Rochester Institute of Technology has been elected president of the Rochester, N. Y. Engineering Society. Other new officers are: Robert B. Jeffers, first vice-president; Dr. George R. Town, second vice-president; Howard Harding, treasurer; Dr. Ray M. Manson and Lewis B. Swift, directors for three years.

The Delaware County, Ind., chapter of the new Indiana Drainage Association has been formed at Muncie, with James L. Luzadder, Gaston, president. Walter E. Kemmer, Muncie, is vice-president, and Gordon Harris, Selma, secretary-treasurer. The chapter is expected to get 200 members interested in a recodification and modernization of the state's drainage laws and in the promotion of water control projects and methods.

Henry H. Morgan, assistant director of the Indiana Economic Council in charge of community planning, has been appointed a member of the Indianapolis, Ind., City Planning Commission, by Mayor Robert H. Tyndall. He fills the vacancy created by the recent death of John W. Atherton, president of the commission for the last five years. Morgan formerly was a member of the commission and prior to that was an engineer for the State Highway Commission and was engaged in state park planning and redevelopment work. He is a member of the American Public Works Association and chairman of that organization's planning committee.

Again GM Diesel power pays off

A 3-cylinder series 71 General Motors Diesel was installed in this Northwest pull-shovel which formerly was powered by a gasoline engine. Right off the bat it got one of the toughest jobs on the list—*6 miles of sewer, 8 to 17 feet deep through solid clay and frozen ground.*

It was a good chance to size up what the new engine could do.

It really walked away with the job—finished it well within the schedule—and cut fuel cost from a $7.00 a day average to $1.80.

Even with all its husky horsepower, a GM Diesel is compact enough to fit installations like this. That's because it's 2-cycle with power at every downstroke. It's all work and no play for pistons in this Diesel.

At the same time GM Diesels are simpler in design and easier to service. They make any machine a better machine—sturdy, dependable, economical. So whatever equipment you buy, specify a GM Diesel.

FEATURES OF THE GM DIESEL

QUICK TO START—
on its own fuel

ECONOMICAL—
runs on low cost fuel

EASY TO MAINTAIN—
clean design plus accessibility

COMPACT—
easily installed or moved

SMOOTH IN OPERATION

QUICK ACCELERATION

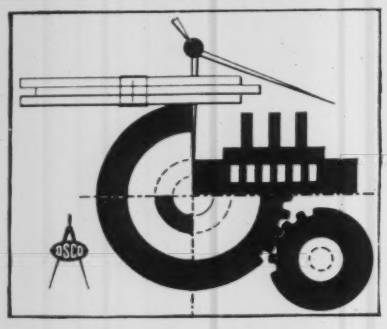
DETROIT DIESEL ENGINE DIVISION

DETROIT 23, MICH. ● { SINGLE ENGINES . . Up to 200 H.P. / MULTIPLE UNITS . . Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK



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WHEN AND WHERE NEEDED

Design Service Co. offers the facilities of its organization including 450 engineers, architects, designers and draftsmen. Complete staffs maintained in New York, Newark, Cleveland and Philadelphia, are available by the day, week or job.

Organizations all over the world are reducing engineering costs and overhead by using Design Service talent. The entire range of engineering is included from elementary tracings to the design of construction machinery, from plot surveys to the complete and detailed design of factories, bridges, hydro-electric plants, etc. No job is too small to receive comprehensive service, and no job is too big to receive competent engineering in all its phases.

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BREAK CONCRETE AND TAMP BACK FILL
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REPAVE IMMEDIATELY

Junior Model T

LOWER YOUR TRENCH WORK COSTS MANY TIMES BY USING RAPID PAVEMENT BREAKER MACHINES.
Write for details, information on other models and prices.
Look for us at the San Francisco Convention.

R. P. B. CORPORATION
1517 Santa Fe Avenue **Los Angeles, 21, Calif.**

Engineering School News

The University of Washington College of Engineering now requires aptitude tests of all high school and junior college students wishing to enroll in its classes, Dean Edgar A. Lowe has announced. The first examination is being given this month.

Harrison Kane won the award in the McLoughlin student paper competition sponsored by the Dam Club of the College of the City of New York on March 21. His subject was "Cultural Courses for Civil Engineers." The club, a fraternity of graduate civil engineers of City College, conducts this contest annually to perpetuate the memory of the late Prof. Frederic O. X. McLaughlin, one of the founders of the school of technology at CCNY. The competition is limited to civil engineering undergraduates who are members of the student chapter of the American Society of Civil Engineers. In his paper Mr. Kane stressed the need for more cultural training in technology schools and recommended lengthening the course from four to five years.

Construction has been started on a new steel frame building 100 by 40 ft. which will serve as an annex to the University of Minnesota's St. Anthony Falls hydraulics laboratory on the Mississippi River. The new structure is an intial step toward providing additional space needed for the university's rapidly expanding graduate study and cooperative research program in fluid mechanics and hydraulics. The new building will provide additional space for hydraulic model studies and make more space available in the main laboratory for graduate research. During the last year the program of the laboratory has become nationwide in scope through the collaboration and sponsorship of many organizations—municipal, state and federal as well as private enterprises. Foreign sponsorship of work in the lab. is under consideration.

Harry H. Hawley, of Columbus, Ohio, a civil and military engineer for 20 years, has been appointed associate professor of civil engineering at Union College, Schenectady, N. Y., it is announced by President Carter Davidson. A graduate of Ohio State University, Prof. Hawley designed bridges for Ohio for 15 years; served as area engineer on the Alaska highway; surveyed and designed airdromes, roads, bridges, hospitals and camps in the Southwest

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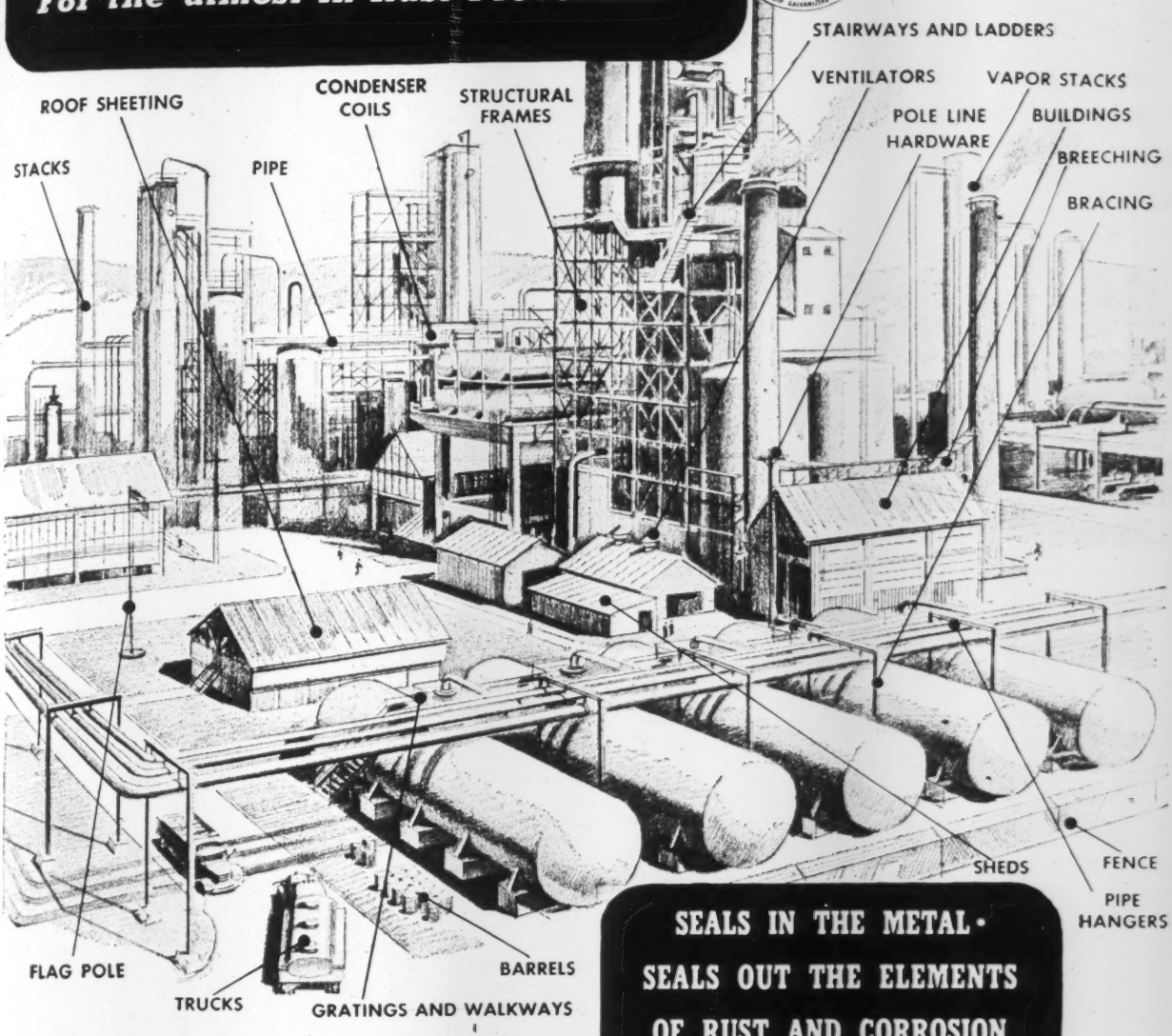
For the utmost in Rust Prevention



SEALS IN THE METAL · SEALS OUT THE ELEMENTS OF RUST AND CORROSION

Oil refineries and exterior plant installations that must give continuous service rely upon Hot-Dip Galvanizing to seal out destructive elements of rust.

Where uninterrupted service, maintenance and replacement costs are of first importance, Hot-Dip Galvanizing always proves its worth. The American Hot-Dip Galvanizers' method of immersing metal in molten zinc provides a definite iron-rich bond that holds the best possible coating of protective zinc to base metal.

Time-proved under every climatic condition, Hot-Dip Galvanizing pridefully points to accumulated evidence—throughout the years—that while metal is sealed in zinc by the American Hot-Dip Galvanizers' process it cannot rust.

Regarding problems of rust and corrosion write American Hot Dip Galvanizers Association, Inc., First National Bank Building, Pittsburgh 22, Pa.

For the best Zinc Coating use **hot-dip GALVANIZING**

● The number of leading manufacturers who adopt Twin Disc Hydraulic Couplings as standard equipment attest to the proved record of Twin Disc units in heavy-duty service. Important factors in achieving this record are sound engineering and the extreme care taken in the construction of all Twin Disc products.

There also is another reason, an important but intangible reason, for the outstanding performance of Twin Disc units. That reason is experience. When Twin Disc selects a unit from its extensive line of standard products for specific application, that selection is made from the knowledge gained through 28 years of specialized clutch experience . . . in matching job requirements to proved performance characteristics of Twin Disc Clutches or Hydraulic Drives. When you have a problem concerning the control and transmission of power, why not put this long experience to work for you? TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Left above: *The Model EH friction clutch is offered in sizes from 14" to 42" in single or two-plate assemblies.*

Right, above: *Twin Disc Hydraulic Couplings are offered in three sizes, 14.5", 17.5" and 21".*

Manufacturers' Activities

JONES & LAUGHLIN STEEL CORP., Pittsburgh, Pa., announces the following personnel changes: D. W. Thomas, assistant general manager sales, tin mill products; J. E. Timberlake, assistant general manager of sales, wire products; J. O'H. Anderson, district sales manager, New York district sales office; S. A. Fuller, manager, market research department; Howard A. Knox, manager of sales, tin mill products; C. E. Kendall, manager of sales, wire products; D. J. Henecker, manager of sales, wire rope products.

EUCLID-CHICAGO CO., 201 North Wells St., Chicago 6, Ill., has been appointed Euclid distributor for northwestern Indiana, northern Illinois and southern Wisconsin. Principals are Robert M. Jones and Horace K. Church. The service and parts department is in charge of Harvey Landmeier; Jack Wathen is office manager.

WILLIAM G. FINDLAY has been appointed manager of the Pittsburgh plant of Joseph T. Ryerson & Son, Inc., succeeding Howard L. Robinson who has been given a special assignment at the Cleveland plant of the company.

WALTER A. OLEN, president of The Four Wheel Drive Auto Co., has been named Wisconsin vice president of the National St. Lawrence Association.

GRINNELL CO., INC., Providence, R. I., has acquired the B. Hoffman Co., Milwaukee, Wis., and will operate it as a division with headquarters at 1819 West St. Paul Ave., Milwaukee, to serve southern Wisconsin, formerly covered from Chicago. Thomas R. Horan has been appointed branch manager, and B. Hoffman, Jr., becomes consulting manager. A. E. Gauslin, Milwaukee manager of the fire protection division of Grinnell, has his headquarters at West St. Paul Avenue.

Two new distributors for BUCYRUS-ERIE ⅜- to 2½-cu. yd. shovels, draglines, clamshell cranes, lifting cranes and dragshovels have been appointed in Tennessee. They are Industrial Tractor & Equipment Co., Inc., Nashville, and the Power Equipment Co., Knoxville.

Completed recently and now occupied, a new plant addition of the BYRON JACKSON pump division, Vernon, Calif.,

Why OPEN WEB STEEL JOISTS?

In the light occupancy buildings of tomorrow, speedy, economical erection and greater utility are paramount. Consider why steel joists are ideal for such structures: Easier to install than wood—conceal pipes and conduits within the floor system—eliminate shrinkage, preventing cracking of ceilings and partitions—termite proof—fire resistive. Particulars available from our field engineers.

WHY SPECIFY CECO JOISTS?

1. Wide top chords provide exceptional lateral rigidity.
2. Twin chords permit secure attachment of floor and ceiling by wire ties or bolts.
3. Hairline contact of bottom chord with plaster prevents streaking.
4. Bearing plates are securely attached, thus eliminating loose parts.
5. Shielded arc welds withstand three times the designed stress.
6. Ceco steel joists are approved by the Steel Joist Institute.

Ceco catalogs are in Sweet's Architectural File

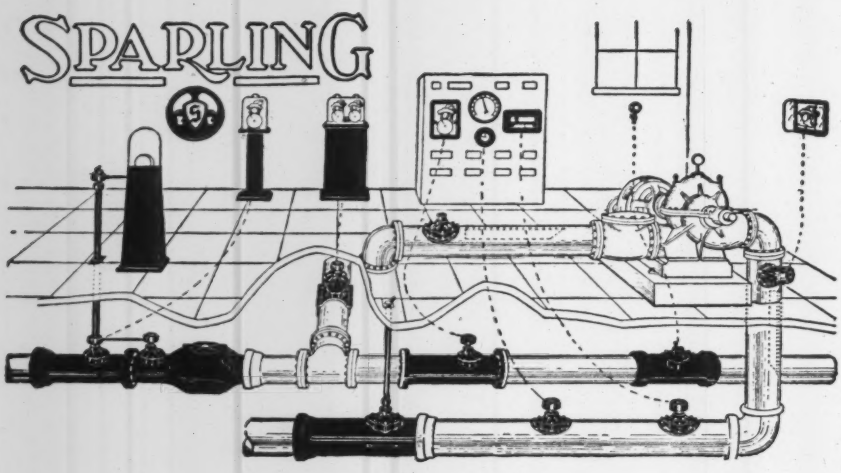
CECO STEEL PRODUCTS CORPORATION

GENERAL OFFICES: 5701 West 26th Street, Chicago 50, Illinois

Offices, warehouses and fabricating plants in principal cities

CECO STEEL

In construction products **CECO ENGINEERING** *makes the big difference*



MAIN-LINE METERS for Efficient Operation

YOU realize the value of 100 per cent metering for consumer services. Complete your metering on pump, reservoir and distribution lines and "spot" even greater wastes! There is a Sparling Meter for every main-line.

Sizes 2-Inch and up

Each meter is a complete Totalizing unit for the consistently accurate measurement necessary to efficient operation. Recorders, Indicators and Controls can be added if and when required.

Details in Bulletin 309
Free Upon Request

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Manufacturers of WATER MEASURING EQUIPMENT

LOS ANGELES 54 . Box 3277 Terminal Annex
CHICAGO 16..... 3104 South Michigan Ave.
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37 YEARS INSTALLING PILES

OF EVERY TYPE

CAST-IN-PLACE CONCRETE COMPOSITE
STEEL SECTIONAL PIPE TIMBER

SOIL AND ROCK BORINGS

MacARTHUR CONCRETE PILE CORPORATION
18 EAST 48th STREET, NEW YORK 17, N. Y.
BOSTON • CINCINNATI • NEW ORLEANS

supplants the present buildings on Slauson Avenue in Huntington Park, occupied since 1920.

Expanded west coast distribution and service facilities for SHEPPARD DIESELS have been announced. A factory branch office has opened at the foot of Hyde Street in San Francisco. The new office will be in charge of Emil Rinetta.

E. E. MICHAELS, manager of the Birmingham division of Chicago Bridge and Iron Company and vice-president and director of AIA, has been made vice-president in charge of operations of the company with headquarters in Chicago.

THE HOLYOKE MACHINE CO., Holyoke, Mass., long known in the paper industry for "Holyoke" paper finishing machinery, cotton and paper calender rolls and other heavy machinery, announce with this issue their entrance into the gravity and pressure filter field. The firm will specialize in filters for municipalities, swimming pools, etc. The filter department is under the direction of John W. Gaitenby.

CHARLES F. YARHAM, formerly an engineer with the Euclid Road Machinery Co., has joined the Ohio Equipment Co., Cleveland, which represents the Yale & Towne Manufacturing Co. in that area.

Assignment of PERMANENTE CEMENT Co., as operator of Pacific Coast Cement Co., Seattle, Wash., plant facilities has been announced. As lessor of the Northwestern cement facilities, General Construction Co. has arrived at satisfactory terms by which the Permanente Cement Co. will manufacture cement at the Seattle plant through February, 1948.

R. J. LOSKILL, former central division credit manager of Caterpillar Tractor Co., has been appointed a central sales division district representative. He will serve the following "Caterpillar" distributors: Gibbs-Cook Tractor & Equipment Co. of Iowa; Halladay-Dettman Co. of South Dakota; Lincoln Equipment Company of Nebraska and Missouri Valley Machinery Co. of Nebraska.

CUMBERLAND PORTLAND CEMENT CO. has moved its general and sales offices from Cowan, Tenn. into expanded new quarters in Chattanooga Bank Bldg., Chattanooga 2, Tenn.

R. BRUCE HUNTER has been appointed manager of the Gary (Ind.) plant of American Bridge Co. W. A. Thiel, who is succeeded by Mr. Hunter, has been placed in charge of construction

FOR RAPID REINFORCEMENTS ON EVERY CONSTRUCTION JOB...

call your local distributor

Almost every day, on every construction job, unforeseen needs arise . . . sometimes for major items like additional equipment . . . sometimes for smaller items like nuts and bolts.

Whatever the need, it affects job progress. It must be taken care of swiftly, economically, and with minimum inconvenience.

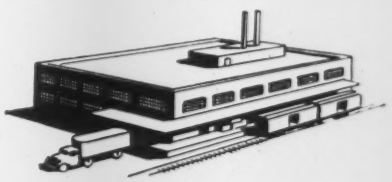
That's where the distributor comes in. Whether you need bolts or bulldozers, you'll get prompt, effective action through your local distributor.

Distributors stock thousands of essential construction items in warehouses and yards convenient to the job. Products of distant manufacturers are immediately available. And if the distributor cannot supply a needed item out of stock, chances are his intimate knowledge of sources of supply and procurement procedures will help obtain it *faster*.

And, in addition to his warehousing and procurement services, the distributor stands ready to make routine and emergency deliveries to the job site.

It's convenient and economical to deal with the local distributor. Ask him to work with you from start to finish on every construction job.

Make Distributor's Headquarters Your Service Headquarters



No. 1 in a series of ads sponsored by ENGINEERING NEWS-RECORD and CONSTRUCTION METHODS showing how distributor service aids economical construction

In One Sewage Job After Another
Springfield Chooses
MORRIS
CENTRIFUGAL PUMPS

10 Morris Pumps in Five Different Stations

Station #1—1925

Three Morris Pumps, 24 inch suction and discharge, vertically driven by 100 HP electric motors. Each pump has capacity of 13,500 GPM against a head of 20 feet.

Station #2—1925

Two Morris self-contained, vertical, submerged pumps with a 5 inch suction and 4 inch discharge. Driven by 10 HP electric motors, they deliver 500 GPM against a total head of 40 feet.

Station #3—1935

Two Morris Pumps, 6 inch suction and discharge, driven by 7½ HP electric motors through a vertical shaft. Each pump discharges 700 GPM against a total head of 20 feet.

Station #4—1938

Two Morris Pumps, vertically driven, powered by 15 HP electric motors. Each pump has 6 inch suction and discharge, and delivers 750 GPM against a total head of 50 feet.

Station #5—1940

One large Morris Pump (stand-by) has a capacity of 6,300 GPM against a total head of 37 feet. Suction diameter is 16 inches; discharge diameter, 14 inches. It is horizontally driven, through a reduction gear, by a 125 HP gasoline engine.

What Morris Pumps Do In Springfield

In one station, three Morris Pumps lift sewage and surface water to discharge the flow into the Connecticut River when flood gates are closed in the outfall sewer.

In another station, built to serve a single street, the sewage flows by gravity from the street into the wet wall of the station. It is then pumped back into the main sewer system by two Morris Pumps.

In the third and fourth stations, the sanitary sewage from low areas is lifted into the main sewer system.

The fifth station is a Main Sewage Treatment Plant, where a large Morris stand-by pump handles surface drainage...occasionally empties primary settling tanks.

Municipalities all over the country specify Morris Pumps, because of their efficiency, economy, long life and consistent output. Feel free to consult our engineers about your particular needs.

Large Cities Everywhere Depend on MORRIS PUMPS

MORRIS MACHINE WORKS
Baldwinsville, N. Y.
Sales Offices in Principal Cities

MORRIS *Centrifugal Pumps*

and maintenance of the company's western division plants at Gary and Minneapolis, Minn.

CECO STEEL PRODUCTS CORP., national manufacturers of metal building materials with general offices in Chicago, has just opened a new New York district plant and office at Hillside, N. J., replacing plant and district office formerly located in Jersey City.

LINK-BELT CO. announces re-establishing a sales office in Washington, D. C. at 1009 Washington Gas Light Bldg., 11th & "H" Sts., N. W., Washington (1), with C. R. ("Pete") Heller, Washington representative, in charge.

Appointment of J. J. O'NEILL as assistant manager of the fleet sales section, Ford Motor Co. truck and fleet sales department, has been announced. S. M. Copland is manager of the fleet sales section.

WILLIAM T. (BILL) KENNEDY has assumed duties as sales representative for the American Hoist & Derrick Co. in the Southwest territory. He will make his headquarters at Houston, Texas.

Two important personnel changes were announced recently by the AMERICAN ROLLING MILL CO., Logan T. Johnston has been appointed general manager of sales and T. F. Olt, director of research. The election of three vice-presidents was also announced: J. A. Ingwerson was elected to the position of vice-president in charge of distribution; C. H. Murray, vice-president in charge of personal and public relations; and H. H. Tullis, vice-president and controller.

Appointment of FRANK S. FOSTER as Caterpillar district representative for the states of South Carolina, Tennessee and Georgia is announced.

The appointment of BECKWITH MACHINERY CO., Pittsburgh, Pa. to handle Marlow pumps to the construction and strip mining industries was recently announced by the Marlow Pump Co., Ridgewood, N. J., through Harris Pump and Supply Co., their Pittsburgh distributors.

E. W. JACKSON has been appointed director of parts and service, Caterpillar Tractor Co., Peoria, Ill. M. T. Deames has the general parts managership; and W. Blackie, vice president and chief administrative head of the accounting and merchandise departments, has also assumed administrative guidance of the traffic department. J. H. Deaderick and E. L. Murray, have resigned their positions to join Fred Elder

YOU, TOO, CAN SAVE MONEY

with a truck like this

Here's a "*Job-Rated*" truck . . . a truck that FITS the hauling job for which it was built!

It stands to reason that a truck that fits its owner's operating conditions will give better performance, better service to customers, and operate at lower cost.

You, too, can buy a truck that will fit *your* job . . . save *you* money!

You can get a "*Job-Rated*" truck powered with exactly the right one of 7 engines—plus the *right* gear ratio—to provide the pulling power you need, with the economy you want.

Such a truck will be built with exactly the right clutch, transmission, rear axle—the right units throughout . . . for "top" performance with your loads over your roads.

You can be so sure of getting a money-saving, long-lasting truck like this, because Dodge builds 175 different "*Job-Rated*" chassis models.

To make sure that your next truck is a dependable, economical "*Job-Rated*" truck, see your Dodge dealer . . . because *only* Dodge builds "*Job-Rated*" trucks.

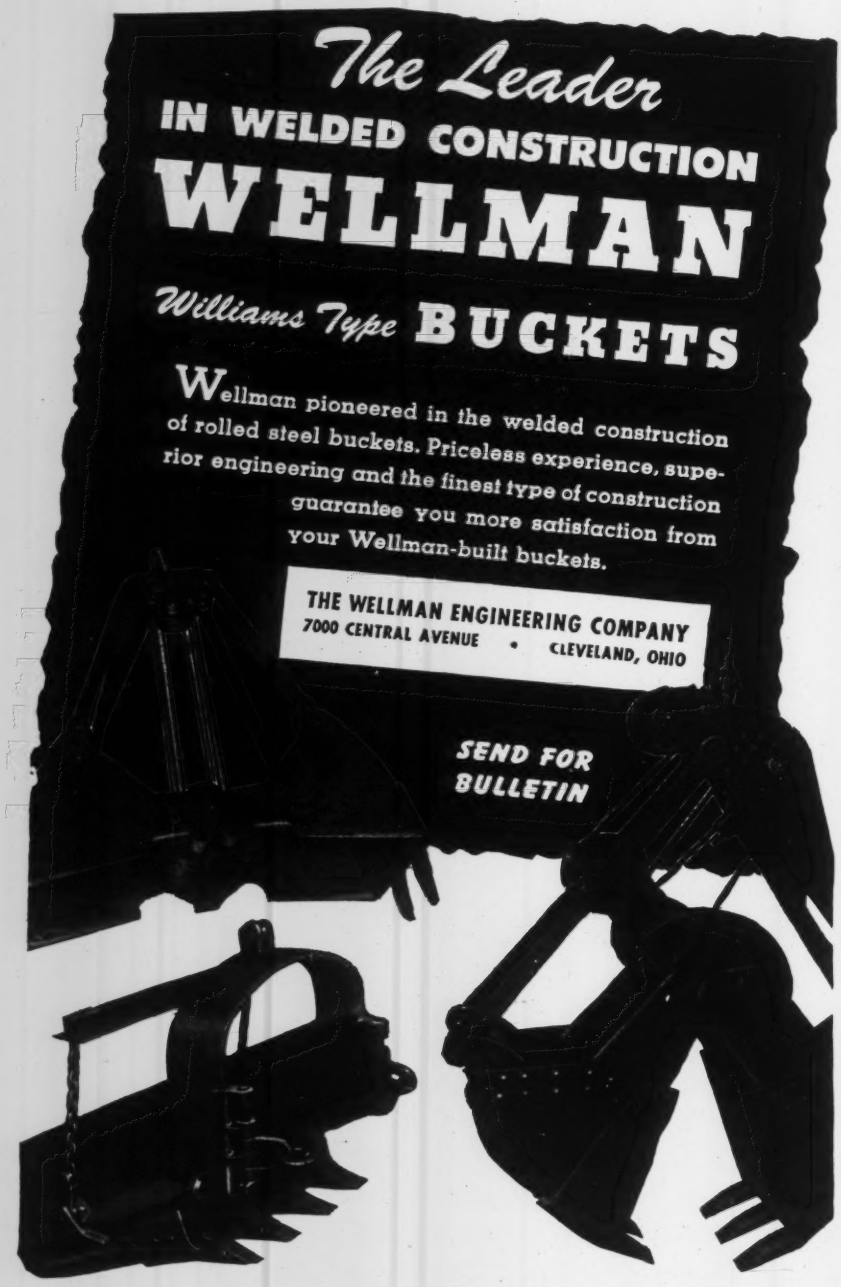
★ ★ ★

Your Dodge dealer is interested in your continued satisfaction: *First*, by selling you a truck that fits your job; *Second*, by giving you prompt, dependable Dodge truck service; *Third*, by providing you with factory-engineered truck parts that are identical with original Dodge "*Job-Rated*" truck parts.

DODGE

ONLY DODGE BUILDS "*Job-Rated*" TRUCKS

Fit the Job . . . Last Longer !


The Leader
IN WELDED CONSTRUCTION
WELLMAN
Williams Type BUCKETS
Wellman pioneered in the welded construction of rolled steel buckets. Priceless experience, superior engineering and the finest type of construction guarantee you more satisfaction from your Wellman-built buckets.
THE WELLMAN ENGINEERING COMPANY
7000 CENTRAL AVENUE • CLEVELAND, OHIO
SEND FOR BULLETIN

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Engineers & Contractors

GUNITE work in all its Branches
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Waterproofing, all types
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MOTT Diamond Core Drilling Contractors

FOUNDATION TESTING
for
Bridges, Dams, Heavy Structures
PRESSURE GROUTING

MFR'S DIAMOND & SHOT CORE DRILLS, GROUT MIXING MACHINES, PACKERS AND GROUT PUMPS

MOTT CORE DRILLING CO.
HUNTINGTON, W. VA.

of Phoenix as Caterpillar distributor for the greater part of Arizona.

ALLIS-CHALMERS tractor division recently announced the appointment of E. J. Mercer as industrial distributor manager for the company's New York State territory.

A new oxygen filling station and acetylene-producing plant are being built at Stockton, Calif. by the LINDE AIR PRODUCTS CO., unit of Union Carbide and Carbon Corp. A warehouse for Union Carbide also will be constructed. The new plants are expected to be completed in the late summer.

Appointment of BOYD O. BACH as manager of sales, fabricated steel construction, Bethlehem Steel Co., Bethlehem, Pa., has been announced.

ROGERS BROTHERS CORP., Albion, Pa. has just announced important changes in its top organization personnel: Harrison J. Rogers has been elected vice-president and general manager. He will continue to function as sales manager. Leo Brennan is controller and assistant secretary and Paul Sheehan is purchasing agent.

GEORGE R. WERNISCH, manager of the steel joist and roof deck division of Ceco Steel Products Corp., Chicago, Ill. was elected president of the Steel Joist Institute at the annual meeting of the board of directors. James D. Maitland, Colorado Builders Supply Co., Denver, Colo., was named vice president.

UNITED STATES STEEL SUPPLY CO. has promoted George B. Parker, former administrative assistant to the sales vice-president for the last two years of this U. S. Steel subsidiary, to become general staff manager of the sales department. He will be responsible for the administration of advertising, commercial research, market development and price policy functions of the company in its nine operating districts. Two other promotions also were announced: Linus E. Olson, formerly staff assistant to the sales vice-president, was made manager of the advertising division, and William A. Crane was made manager of the commercial research division.

The name and address of Union Iron Works, Inc., has been changed to The UNION IRON WORKS OF NEW JERSEY CO., Inc., Beacon, N. J.

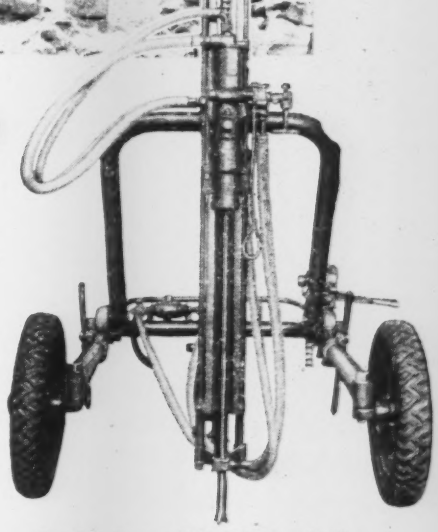
Announcement is made by the GOODALL RUBBER CO., INC. of the opening of an affiliated company to be known as the Goodall Rubber Co. of Minnesota.

Tough Terrain?

Not for a Gardner-Denver UM99

Highly mobile—easy to move or to tow—Gardner-Denver UM89 and UM99 Wagon Drills "get around" where the going is tough. Six-foot steel changes make short work of big jobs—high drilling efficiency piles up more footage per shift. Here are additional reasons why so many owners prefer a Gardner-Denver:

* *Provides a flexible means of mounting any type of drill for varying conditions.*
* *Wheels adjustable to two positions—one parallel to main frame and other at right angles to main frame.*
* *U-frame adjustable from a position slightly below the horizontal through an arc of 90 degrees to one practically vertical.*
* *Pneumatic feed easily adjusted to any position for work from vertical to horizontal.*
* *Holes kept free of cuttings by constant blowing device as well as by auxiliary blower which forces sudden blast of air to bottom of hole.*



Gardner-Denver UM99 Wagon Drill

GARDNER-DENVER
SINCE 1859

For complete information, write
Gardner-Denver Company, Quincy, Illinois

KEEP THOSE CONCRETE EXPANSION JOINTS SEALED ALL YEAR 'ROUND!

SPECIFY

THE ORIGINAL

Para-Plastic

REG. U. S. PAT. OFF.

HOT-POURED RUBBER SEAL

PARA-PLASTIC is the ORIGINAL hot-poured rubber seal for concrete expansion joints.

PARA-PLASTIC remains flexible all year 'round. Its elasticity is permanent in any temperature without breaking its bond with concrete.

PARA-PLASTIC is the positive and permanent top seal for concrete expansion joints all year 'round against the infiltration of water.

Write for further technical information

"STICK" WITH THE ORIGINAL ALL YEAR 'ROUND

SERVICISED PRODUCTS CORP.
6051 West 65th Street Chicago 38, Ill

Manufacturers' Publications

Power Saw—Bulletin 132 describes the new Nordberg-Buday portable power saw and outlines its uses and advantages. This 4-p. bulletin, printed in color, is illustrated with pictures showing capacity, and various cuts that can be made without rehandling the lumber. Operating features, specifications and weights are also given.—*Power Tool Dept., Nordberg Manufacturing Co., Milwaukee, 7, Wis.*

Swimming Pool Filters—Bulletin No. 8 on swimming pool filters concisely outlines the sanitary requirements of water for swimming pools, explains the equipment required, and includes a flow diagram showing the arrangement of a representative pool with necessary filtration equipment.—*Liquid Conditioning Corp., 114 East Price St., Linden, N. J.*

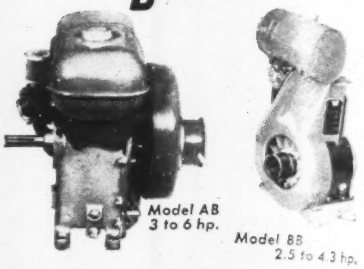
Water Hammer — 6-p. booklet, "Water Hammer—Its Cause and Cure" includes the most authoritative information on the little known subject of water hammer yet assembled in printed form. Condensed facts, gathered from years of water hammer study by Wade engineers, are presented in simple, easily understood language. The Wade sealed air chamber is introduced as the scientific answer to the problem. Also included handy selector tables and pressure flow charts.—*Wade Manufacturing Co., Elgin, Ill.*

Glass, Paint and Metal—(New edition, data sheet handbook) Answers all questions concerning products of the company, as well as of Pittsburgh Corning Corp. It is made up of a handy pocket-sized loose leaf folder containing individual sections indexed for ready reference. — *Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh 22, Pa.*

Cellar Stair Unit—(4-p. folder) Describes stair units, fabricated of a special grade of steel, which include side walls for cellar-way as well as risers and treads.—*Bilco Co., 164 Hallock Ave., New Haven, Conn.*

Valves and Fittings—Features of 2-color, 8½x11, 54-p. catalog No. 47 include complete descriptions of all standard Alcoyco corrosion resistant valves

BEE-LINE ENGINES



In Volume Production

Prompt Delivery

These 4-cycle, air-cooled gasoline engines are thoroughly service-proved in many applications. Light weight, compact design, and wide power range mean ready adaptability to many types of equipment and powering problems. Backed by 28 years of engine building experience, including manufacture of the famous Kinner aircraft engines.

Gladden Products CORP.

635 W. Colorado Blvd., Glendale 4, Calif.

KEEP YOUR CONVEYOR BELTS GOING

FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

● Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

FLEXIBLE STEEL LACING CO.
4656 W. Lexington St., Chicago

Write for your copy.

FLEXCO H D BELT FASTENERS

Sold by supply houses everywhere

Drift Bolts

Ideal for timber construction, Bethlehem Drift Bolts are furnished plain or galvanized in a complete size range, and in the following styles—Bodies: Round or Square. Heads: Button, Countersunk, Square and Headless. Points: Wedge, Semi-Cone, Full-Cone, No-Point. Because of the variety of Bethlehem Drift Bolts, it is important that inquiries specify the style of body, head, and point desired.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Other Bethlehem Construction Fastenings

BOLTS and NUTS... TURNBUCKLES... CLEVISES... RIVETS... SPIKES... WASHERS

It Was
90 YEARS AGO

Where Mueller Business Started in 1857

in a small building in Decatur, Illinois, that Hieronymus Mueller established the basic principles of Mueller Co—practical design, superior quality and fine workmanship. That these tenants were sound is evidenced by Mueller Co.'s leadership in the Water, Gas and Plumbing Industries where four large modern factories and other strategically placed sales offices now offer unsurpassed service to the trade.

Main Office and Factory, Decatur, Illinois

- Tapping and Drilling Machines
- Tapping Sleeves and Valves
- Corporation Stops
- Branch Connections & Goosenecks
- Curb Stops
- Service Boxes
- Service Clamps
- Tools & Equipment
- Meter Box Covers and Yokes
- Copper Service Pipe & Fittings
- Fire Hydrants & Gate Valves
- Water Control Equipment
- Line Stoppers
- Regulators & Relief Valves
- Plumbing Brass Goods

Factory, Chattanooga, Tennessee.

Factory, Los Angeles, California.

Factory, Sarnia, Ontario, Canada.

DEPENDABLE SINCE 1857 — FULLY WARRANTED — OUR 90th YEAR

MUELLER CO.

MAIN OFFICE AND FACTORY ..... DECATUR, ILLINOIS
OTHER FACTORIES: *Los Angeles, Cal.; Chattanooga, Tenn.; Sarnia, Ont. Canada*

and fittings, with photographs and cross sections, dimensional data and list of alloys in which each style is stocked.—*Alloy Steel Products Co., Linden, N. J.*

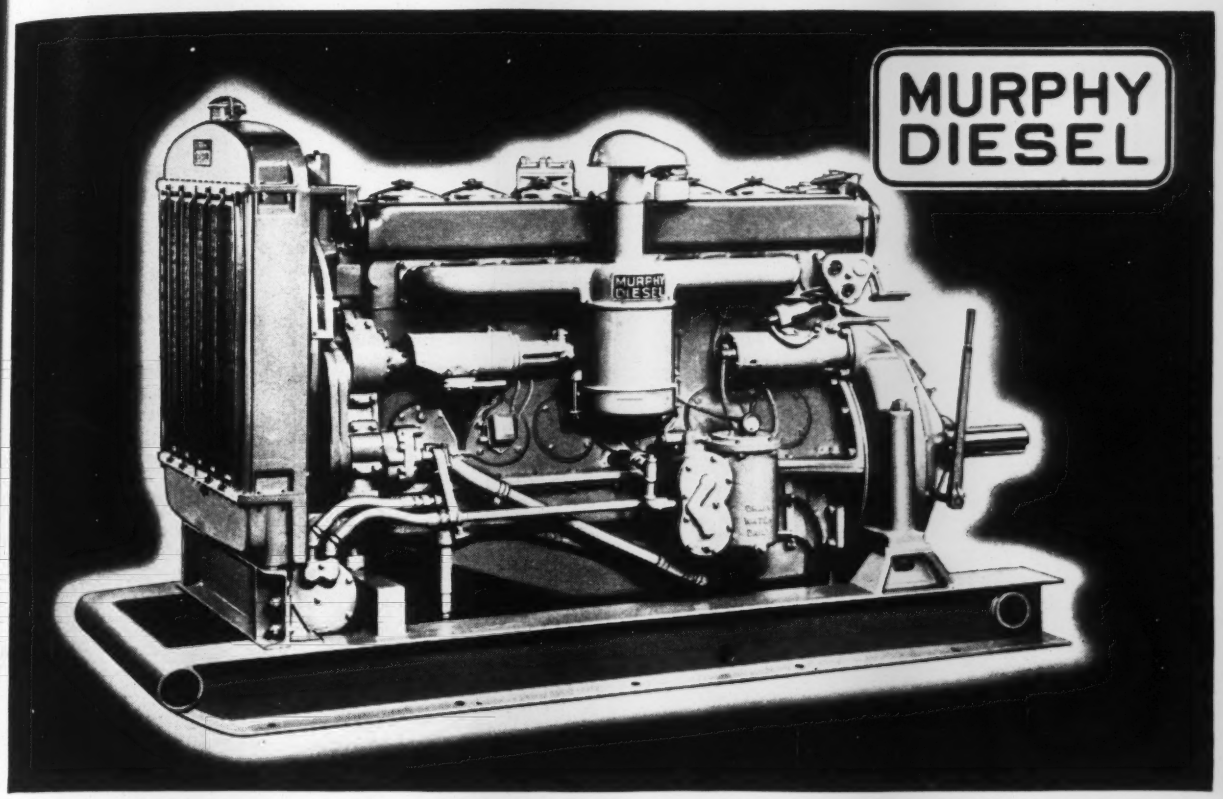
Sewer Cleaner—A 4-p. 2-color circular describing the "Flexi-Cleaner," an electric motor-powered sewer and pipe line cleaning machine, gives complete details concerning the portable, three-speed, reversible and highly adaptable power cleaner. Various cutting head tools are illustrated and described. Methods employed for clearing stubbornly blocked lines provide valuable reference matter.—*Flexible Sewer-Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.*

Hotel Heat Controls—A new handbook on automatic control instruments for the modern hotel describes in non-technical terms controlling and recording instruments designed to make hotel operation more efficient and provide greater guest satisfaction. Among the new controls listed is a window switch that shuts off the radiator valve whenever the window is opened; a system of individual thermostats for each room makes possible average fuel savings of 20 percent yearly. Controls for process steam, air conditioning regulation and other control problems are discussed.—*Minneapolis-Honeywell Regulator Co., New York, N. Y.*

Tile and Cast Iron Conduit Systems—Specifications and descriptions of various basic types of tile and cast iron conduit for underground steam, return, hot water and oil lines are the subject of a 4-p. standard file-size folder, (Form 4704). A practical aid to architects and engineers, the folder contains engineering data, showing trench dimensions and pipe locations recommended for each size and type of conduit.—*Ric-wil Co., Cleveland, Ohio.*

Architectural Symbols — Architect-Aid No. 29, expressly for the architect, draftsman and building contractor, has cut outs which provide a quick, uniform and neat delineation of the most commonly used architectural symbols. Drawing time of repetitious symbols is cut to a minimum. The template is a transparent plastic 2¾ x 10 in., with rounded corners. List prise $2.00—*Charles Baron, Rapidesign, Inc., P.O. Box 592, Glendale, Calif.*

Controlled Vibrations—Bulletin 266 on the Baldwin Lazan oscillator—a compact, portable machine for inducing controlled vibrations in structures and assemblies—has just been announced.—*Testing Equipment Dept., Eddystone Div., The Baldwin Locomotive Works, Philadelphia, Pa.*



A MURPHY DIESEL ME-66, 6-cylinder, 6 x 6½" engine, 180 HP intermittent, 150 HP continuous, powers this portable agricultural limestone crushing plant.

Portable Crushers Powered Dependably

MURPHY DIESELS have plenty of the kind of crushing power it takes to "make rock" fast and profitably. This fact has been demonstrated beyond doubt on many crushing plants.

Also on many other types of heavy-duty equipment operating profitably in the construction industry, MURPHY DIESELS have proved themselves the ideal heavy-duty engines. Specify them on new and rebuilt equipment for dependable, profitable performance. Write for bulletin.

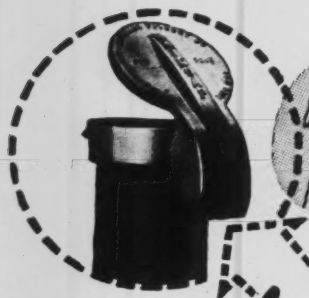
MURPHY DIESEL COMPANY
5311 West Burnham Street, Milwaukee 14, Wisconsin

DIESEL ENGINES: 90 HP TO 215 HP

MURPHY DIESEL

GENERATOR SETS: 60 KW TO 115 KW

Dependable Heavy-Duty Power



RAINCAP

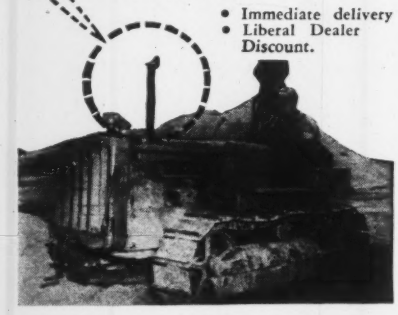
New!

THE CAP THAT DOES NOT FORGET TO CLOSE
Completely automatic—the "RAINCAP" is counterbalanced to open when the tractor starts and close when it stops. Rust proof — made of cast aluminum — can be installed in two minutes. F.O.B. Waterloo, Iowa.

- Immediate delivery
- Liberal Dealer Discount.

STOPS MOISTURE FROM FALLING INTO TRACTOR EXHAUST . . Just slip the "RAINCAP" over the open end of your tractor exhaust, and you eliminate forever the danger of moisture falling into the exhaust, injuring your tractor.

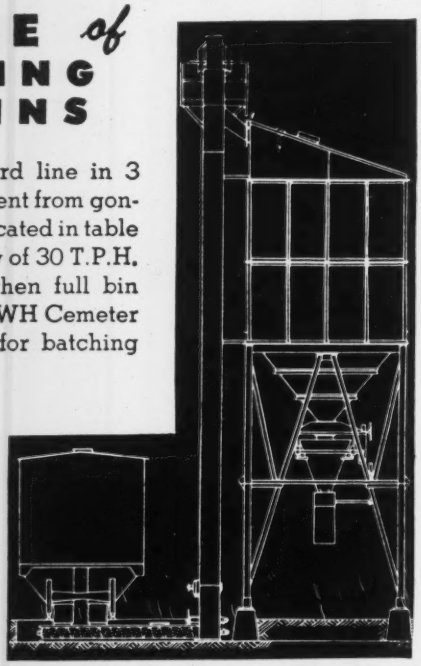
No.	*O.D. Exhaust*	*Price*
1	2 1/8"	$1.90
2	2 3/8"	1.90
3	2 3/4"	1.90
5	1 7/8"	1.90
55	2"	1.90
6	1 1/2"	1.90
7	2 1/2"	1.90
8	3"	2.50
9	3 1/8"	2.50
10	3 1/4"	2.50
11	3 1/2"	2.75
12	4"	3.00



WATERLOO FOUNDRY CO., WATERLOO, IOWA

A NEW LINE of CAR LOADING CEMENT BINS

WE have developed this standard line in 3 popular sizes for hauling bulk cement from gondola cars to bin. Capacities are indicated in table below. Bucket elevator has capacity of 30 T.P.H. High level bin signal indicates when full bin capacity has been reached. Type DWH Cemeter provides 8 to 20 cu. ft. capacity for batching service. *Write for complete data.*



BIN	CAPACITY	
	CU. YDS.	BBLS
1	29	172 to 194
2	45	270 to 304
3	73	437 to 492

ERIE AGGREMETER PLANTS

Erie Steel Construction Co., 267 Geist Rd., Erie, Pa.

BUCKETS • AGGREMETERS • PORTABLE CONCRETE PLANTS

Pacific theater; and taught three years at Ohio State. Now an associate professor of civil engineering there, he will begin duties at Union in September.

Syracuse University, Syracuse, N. Y., has bought a war-surplus factory for use as a vocational training school in connection with the engineering department. Sale of the factory, the Lipe Rollway Corp. plant in Syracuse, for $214,500 has been announced by the War Assets Administration. Consisting of a 6-story steel and concrete building with 81,270 sq.ft. of space, four minor structures, and about three acres of land, the property cost the government $555,000.

Ten graduate fellowships in traffic engineering, available through grants from the Automotive Safety Foundation and the American Transit Association, are announced by the Bureau of Highway Traffic of Yale University. They amount to $1,400 each and provide for an academic year of gradute study beginning Sept. 22 next. The awards are open to men with degrees in engineering from any accredited college. Applications must be made by June 15 next.

Establishment of a scholarship by the Grand Island, Neb., Engineers Club with the University of Nebraska Foundation has been announced. It will provide a minimum of $100 annually for one or more scholarships for students of engineering. Recipients must be able to do satisfactory college work, show promise of success, and be in need financially. Preference will be shown to graduates of Hall County high schools. The dean of the engineering college will make the awards.

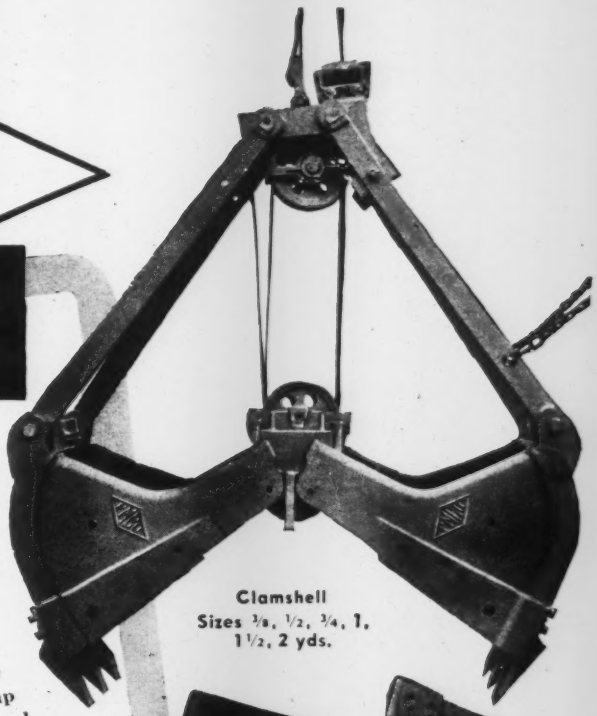
New appointees to the faculty of the college of engineering at the University of Florida are George R. Grantham, assistant professor in sanitary engineering, formerly instructor in civil engineering at the Illinois Institute of Technology, and Arthur E. Lewis, instructor in civil engineering, who has had experience in the Florida State Road department testing laboratory.

Carl Smith of the U. S. Bureau of Reclamation, Denver, Colo., was winner of the Ketchum Award for 1946 at the University of Colorado. The award was established in 1936 as a tribute to the late Milo S. Ketchum who was dean at Colorado from 1904 to 1919 and at the University of Illinois from 1919 until his death in 1934.

PMCO

America's Most Complete Line of Material Handling Buckets

All purpose
- SHOVEL
- PULLSHOVEL
- DRAGLINE
- CLAMSHELL



Clamshell
Sizes 3/8, 1/2, 3/4, 1, 1 1/2, 2 yds.

• FRONTS, BOTTOMS, SCOOPS AND TEETH are 14% manganese steel developing tensile strength up to 120,000 p.s.i. This high percentage manganese steel gives tough, rugged strength for hard service and allows wide set corner teeth for easy entrance in digging. Volume production methods enable us to build a better bucket with amazing economies in manufacturing.

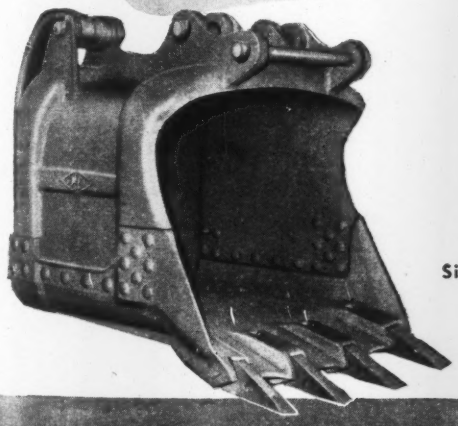
Pullshovel
Sizes 3/8, 1/2, 5/8 and 3/4 yd.

On the 1/2 yd. and 3/4 yd. Shovel and Pullshovel Buckets, all teeth are interchangeable — a great advantage to operators.

Experience Counts

See your shovel man or equipment dealer about PMCO Buckets and Dippers.

Dragline
All Purpose Sizes 3/8 to 2 yds.
Stripping sizes 2 to 9 yds.



Shovel
Sizes 3/8 to 18 yds.

"Quality Since 1880"

PETTIBONE MULLIKEN CORP. CHICAGO 51, U. S. A.

WE OPERATE THE LARGEST AND MOST COMPLETE MANGANESE STEEL FOUNDRY IN THE UNITED STATES.

Keep Exterior Walls Healthy with HYDROCIDE Colorless

Continual exposure to changing weather conditions is eventually as hazardous to a brick, concrete, masonry or stucco structure as to a human being. "Weatherizing" exterior walls with the proper water-repellent treatment – HYDROCIDE Colorless – will help keep them healthy through rain and snow, heat and cold.

HYDROCIDE Colorless is not affected by extremes of temperature . . . remains fluid at low temperatures and will not show separation and precipitation. It is free of resins, wax, and other non-penetrating matter.

Since HYDROCIDE Colorless forms a transparent film, it does not mar the original beauty and appearance of the surface. Absorption of dust, soot and stains is checked. Application is easy – by brush or spray.

Two types: HYDROCIDE Colorless "G" for relatively dense surfaces – HYDROCIDE Colorless "D" for porous light colored surfaces.

WRITE FOR *FREE FOLDER* on
extending life of exterior building walls.
Address Dept. **E-7**

SONNEBORN
"BUILDING SAVERS"

Floor Treatments • Waxes • Paints and Protective Coatings • Concrete and Mortar Admixtures • Waterproofing and Dampproofing • Caulking Compounds Roof Coatings

IF IT'S WORTH BUILDING IT'S WORTH SAVING

Building Products Division, **L. SONNEBORN SONS, INC.,** New York 16, N. Y.
In the Southwest: Sonneborn Bros., Dallas 1, Texas

Metallurgical research building for Iowa State

The U. S. Atomic Energy Commission has alloted funds for the construction of a building at Ames, Iowa, to be used by the Iowa State College in its metallurgical research development. Plans for the 4-story, $1,000,000 brick building containing 700,000 cu.ft. are being drawn by Tinsley, Higgins and Lighter, Des Moines architects. Construction bids are to be asked June 15.

The building and research program will be under the jurisdiction of the Iowa State College Institute for Atomic Research, headed by F. H. Spedding.

Large power expansion planned for Indiana

The Public Service Company of Indiana, Inc., which has spent $112,000,000 in building its present electric utility system in the state, is now planning to invest $52,000,000 more in the next five years.

This proposed expenditure is divided as follows: For new electric power production, $18,700,000; for new power transmission, $14,500,000; for power distribution, $5,700,000; and for extensions, renewals and improvements of the present electric utility system $13,100,000.

Three Rio Grande dams are being considered

Three international dams are being considered for the Rio Grande River, it was disclosed last week when engineers from the McAllen, Tex., field office of the Bureau of Reclamation conferred in Washington on a proposed gravity canal from the first of the dams.

Under the United States-Mexico water treaty, the International Boundary and Water Commission would do the work of building the dams, which are planned for both irrigation and power purposes.

The Reclamation Bureau will distribute the stored water on the United States side of the Rio Grande, with the Mexican irrigation commission in charge on the south side.

Engineering details of the dam and canal have not yet been discussed by the commission and the bureau.

Reflecting paint used for highway safety

Motorists using the Lincoln and William Penn Highways in Pennsylvania soon will have the added protection of

1/2 the Time : 1/2 the Cost

New System of Form Construction Offsets Today's High Costs

Patents Pending

All Steel, but light weight—even a five year old can lift them.

JUST SEND US prints of the job and let us show you how much you can cut your costs with Atlas Speed Forms. New technique in form construction with layouts, job and cost studies, standardized steel forms and recommendations applicable to individual conditions.

Steel SPEED Forms are now in use on more than 30,000 structures. Leading contractors find there's no equal and repeat order again and again.

SPEED Forms go together with wedge bolts and clips. Easily assembled with a hammer . . . no special wrenches or tools needed. No joists on slabs—no studs on walls. Can be easily erected and stripped in *half* the time and at *HALF* the cost of wood.

Available Now For Rent or Sale

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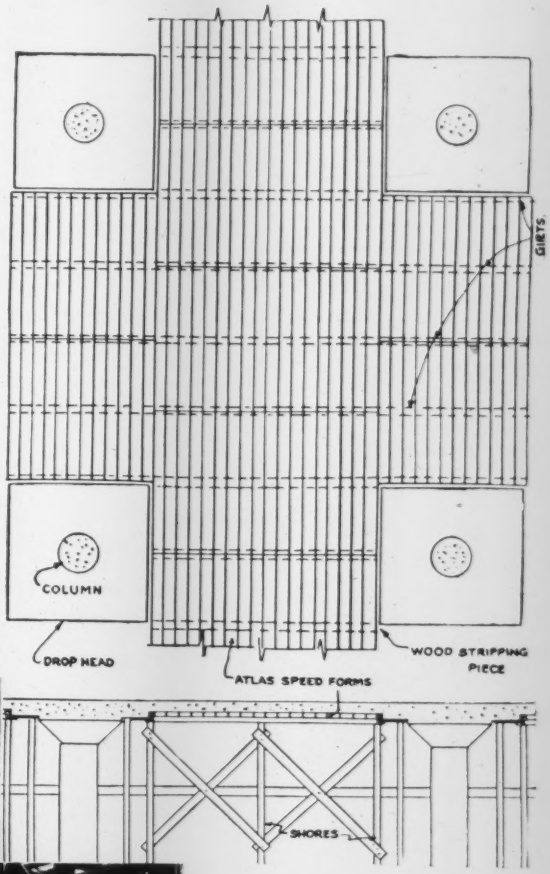

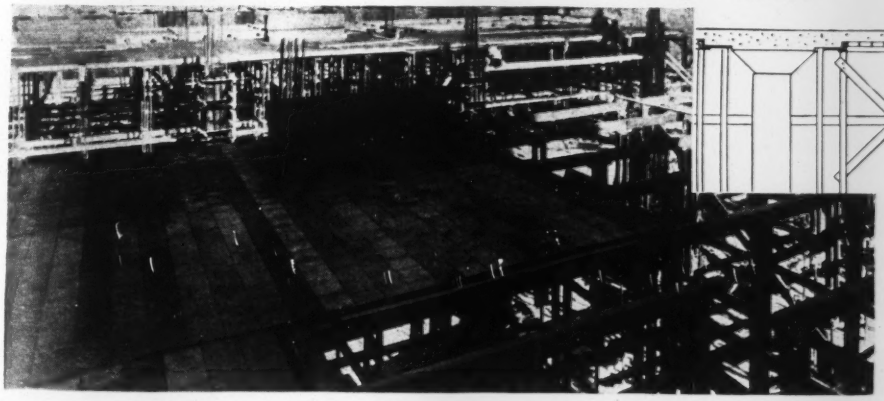

Note the ease of construction and continuous lines formed with 6" x the 8" wide units. SPEED Forms can be re-used indefinitely without repair.

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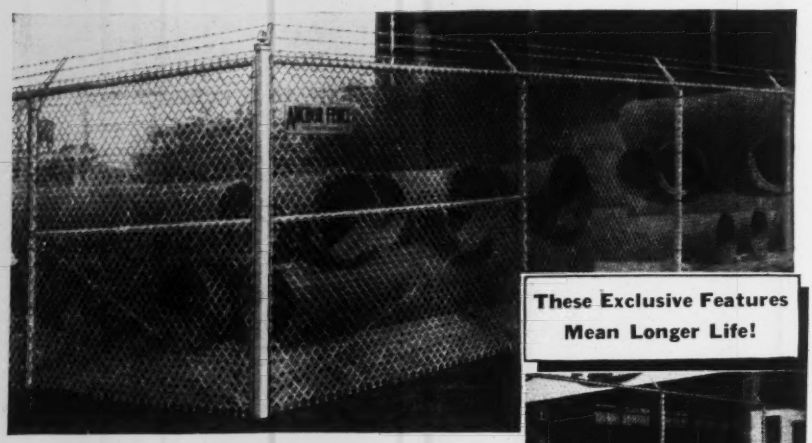

These Exclusive Features Mean Longer Life!

DEEP-DRIVEN ANCHORS are clamped to the posts at right angles to the fence line—form a 3-point "tree-root" anchorage deep in the sub-soil.

How to PROTECT OUTDOOR STORAGE of MATERIALS and SUPPLIES!

You can make full use of your outdoor space . . . for storing materials and supplies . . . when your property is fully protected by an Anchor Chain Link Fence. That means you'll be able to free valuable factory floor space for production without building at this time. What's more, an Anchor Fence will also control employees and motor traffic in and out of your plant—keep out trespassers, agitators and other trouble-makers.

Write today for your free copy of our Book No. 110 . . . showing types of fence, construction details, photographs of prominent industrial installations. Or let us have one of our experienced engineers call and give you the benefit of his knowledge in solving protection problems. Address: ANCHOR POST FENCE DIV., Anchor Post Products, Inc., 6665 Eastern Ave., Baltimore 24, Md.

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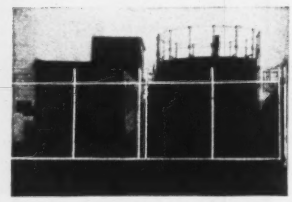
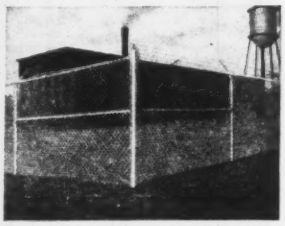


SQUARE FRAME GATES of square steel tubing. Anchor gates are butt-welded at corners to prevent sagging, warping.



SQUARE TERMINAL POSTS are stronger than round posts of comparable size. Cross-bracing to adjoining line posts adds extra rigidity.

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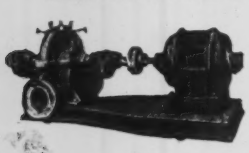

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reflectorized traffic line paint [illegible] F. Smock, secretary of highways, has announced. The department will use 10,000 gal. of this paint on the two major east-west highways.

The paint consists of glass beads imbedded in paint to reflect the headlights of oncoming vehicles. It has been used primarily at bridge and subway approaches.

Announce two new plants for Pittsburgh area

In one day recently two Pittsburgh, Pa., companies announced extensive expansion programs involving expenditure of $5,500,000 for construction. The Disco Co., a subsidiary of the Pittsburgh Consolidation Coal Co., will construct a $3,000,000 smokeless fuel producing plant at Champion, 19 miles west of Pittsburgh. Ground is to be broken this month and the company expects to have the plant ready for production by the fall of next year, to turn out 280,000 tons of coke annually. The Allis-Chalmers Manufacturing Co. will start work in a few weeks on four new buildings, near the present Northside transformer plant, to cost about $2,500,000 and to add more than 500 new employees.

Reclamation Bureau gets new Phoenix office

The Phoenix, Ariz., office of the U. S. Bureau of Reclamation, under the supervision of Regional Planning Engineer V. E. Larson, has moved to 337 West Washington Avenue. The new quarters will provide floor space of approximately 3,000 sq. ft.

New space was obtained in the congested Phoenix downtown area only through the cooperation of Governor S. P. Osborn, Mayor Ray Busey, and City Engineer R. G. Baker.

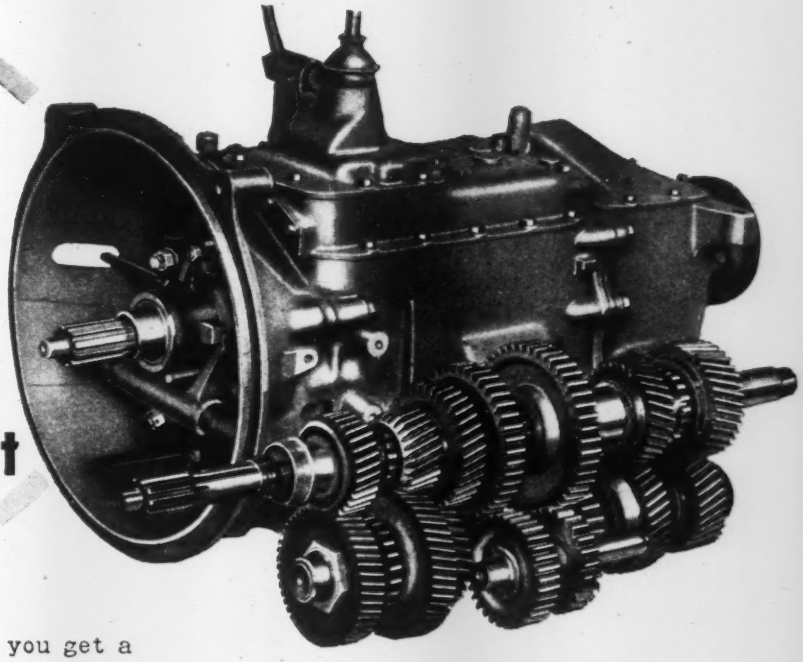
Iowa state building plans are revamped

The Iowa state office building committee has directed Burdette Higgins, of Des Moines, to revamp plans for the long-delayed state office building on the statehouse grounds to make the building a 6-story instead of a 5-story structure as originally planned.

Higgins estimated cost of the additional floor at $380,000. The building is to be 120 by 240 ft. and of steel and concrete construction with Bedford stone facing.

The building originally was proposed

TEN speeds in ONE compact unit



Only in Mack trucks or tractors can you get a transmission like this.

It's the Mack Duplex, with ten speeds forward and two reverse — the only two-range, multi-speed arrangement designed and built as an integral unit.

Because it is mounted as a single, complete assembly, the Duplex eliminates the complications of auxiliary transmissions or two-speed axles.

Simpler ... lighter ... more efficient ... it provides ten separate and useful ratios, properly spaced through a liberal range. It assures smooth, even progression through all speeds. It requires but one support and only one bath of oil. And it takes up but little more space than a standard five-speed box.

The Mack Duplex is built entirely in Mack factories ... product of the finest and most modern gear-cutting facilities in the industry. It's one more example of the way Mack's better design pays off in better performance — on the job.

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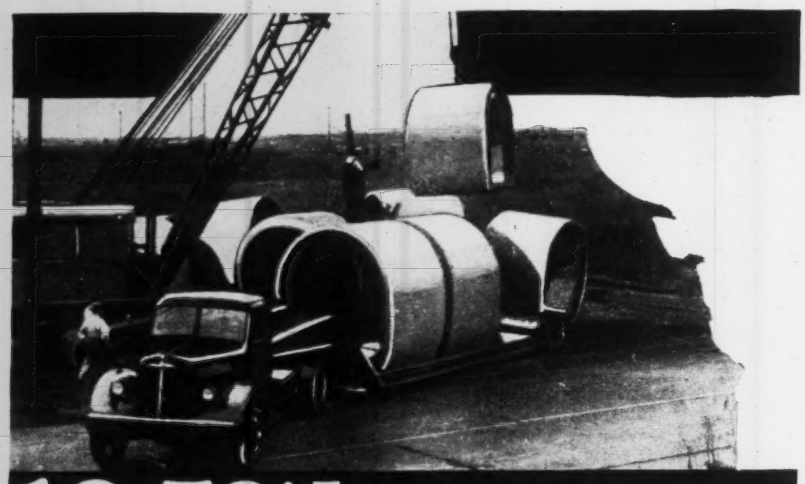
Trucks for every purpose

Mack Model LMSW-M is engineered specifically for heavy-duty, off-highway service. As a dumper, it hauls big yardage per load with maximum trips per hour — the formula that transforms ore, rock, coal or earth into real pay dirt. This diesel-powered unit, with 15-ton side-dumping body, is one of three working for Lone Star Cement Co. at its limestone quarries in Greencastle, Ind.

5211



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by the 1941 legislature which appropriated $1,600,000 for its construction. Since then another $935,000 has been added to the building fund.

N. C. plans big program of road improvements

North Carolina plans to grade, surface or stabilize an estimated 11,186 miles of roadway this year at a cost of $43,853,437, according to the State Highway and Public Works Commission. This is the largest highway expenditure ever planned by the state.

Of the total, it is estimated that $32,288,471 will be expended for the improvement of the county road system, with the remaining $11,564,966 to be used on the state highway system.

Engineer examiners chosen in Kansas

Gov. Frank Carlson of Kansas last week had named the personnel of the 5-man State Board of Engineering Examiners, making it the first group to be appointed of the eight new boards and commissions created by the last legislature.

The members are: R. A. Seaton, dean of Kansas State College at Manhattan, specialist in mechanical engineering; G. W. Bradshaw, professor of civil engineering at the University of Kansas, Lawrence; L. W. Newcomer, Eldorado, county engineer of Butler County; C. V. Waddington, Wichita, electrical engineer, and Murray A. Wilson, Salina, consulting engineer.

Kentucky may run hotels in its state parks

The governor's cabinet in Kentucky has authorized Conservation Commissioner Harold A. Browning to negotiate the issuance of revenue bonds to build tourist hotels, cabins and other facilities at six state parks at an estimated cost of more than $1,500,000.

The state-owned hotels will be operated by the parks division and not by private concessionaires. It is proposed to have the legislature create a 9-man commission to operate all Kentucky state parks.

Mexico—The investment of about $7,000,000 the Mexican government is to make this year in railroad construction has been broken down as follows by the Ministry of Communications and Public Works: